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GSM BASED EMERGENCY NOTIFICATION VIA SMS

MOHD RIZUAN BIN MAT AMIN

A thesis submitted in fulfillment of the
requirements for the award of the degree of Bachelor of
Engineering (Electrical - Telecommunication)

Faculty of Electrical Engineering
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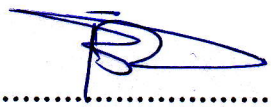

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Name : MOHD RIZUAN BIN MAT AMIN

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To my parents,

Mat Amin Bin Sulong & Late Zainun Binti Ali

To my adoptive mother,

Maimunah bt Ismail

To my siblings

Kamariah, Yusuf, Asro, Rohayu, Mariati

To my helpful friends

Zaki, Shafiq, Najib,

To all my lovely course mates

4SET 2011/2012

To my specials

Nurul Syazlin Binti Saharin

Thank you for always with my side along to complete this journey, I very appreciate with your support and help.

Thank you for all the memories.....

ACKNOWLEDGEMENT

Alhamdulillah and thanks to Allah S.W.T because I can finish my work for final year project with successfully.

I am very thankful to everyone who all supported me for I have completed my project effectively and moreover on time.

I am equally grateful to my supervisor Pn Fareha Bt Abd Rahman. She gave me moral support and guided me in different matters regarding the topic in how to do my research. She had been very kind and patient while suggesting me the outlines of this project and correcting my doubts. I thank her for her overall supports.

Besides that, l also thank to Mr Hamdan, Phd student at telecom lab because help me a lot while doing the program for the PIC.

ABSTRACT

Human nowadays are exposed to the roadside danger especially women. Women are especially prone to be the victims of snatch thieves. If this incident happens, they do not know how to handle the situation and become panic for instantly losing all of the important things such as hand phone, driving license, and sometimes jewelry. At a time like this, all women would wish to have a device that can send an auto and immediate SOS message instantaneously to a close friend or to a nearby police station.

This project is to design such a device. A device consists of small transmitter, GPS receiver and GSM modem that can be used to send an immediate message to the preselected numbers within a short time. The device should also give information on the exact location of the incident. In other words, a system is created so that it could be a backup device if the entire telecommunication devices are taken away. The victim does not have to call the emergency number like 999 and describe the situation or to write a message, but she just need to press a button. In a short time, the auto message will be sent.

The major part of this project is on writing the source code using C language so that the GPS module and GSM modem can be connected together and functioning well. When the GPS module received the information about longitude and latitude, the information will be send to the GSM modem. Then, the GSM modem will send the message to the user as an end of receiver.

ABSTRAK

Sekarang manusia terdedah kepada bahaya di tepi jalan terutamanya wanita. Wanita adalah lebih terdedah untuk menjadi mangsa ragut pencuri. Jika kejadian ini berlaku, mereka tidak tahu bagaimana untuk menangani keadaan tersebut dan menjadi panik serta-merta kehilangan semua perkara penting seperti telefon bimbit, lesen memandu, dan kadang-kadang barang kemas. Pada masa seperti ini, semua wanita ingin mempunyai alat yang boleh menghantar mesej automatik dan serta-merta SOS serta-merta kepada rakan rapat atau ke balai polis berdekatan.

Projek ini adalah untuk merekabentuk peranti sedemikian. Sejenis alat yang terdiri daripada pemancar kecil, modem penerima GPS dan GSM yang boleh digunakan untuk menghantar mesej segera kepada nombor diprapilih dalam masa yang singkat. Peranti juga harus memberi maklumat mengenai lokasi sebenar kejadian itu. Dalam erti kata lain, sistem diwujudkan supaya ia boleh menjadi peranti sandaran jika peranti telekomunikasi seluruh dibawa pergi. Mangsa tidak perlu untuk memanggil nombor kecemasan seperti 999 dan menerangkan keadaan atau menulis mesej, tetapi dia hanya perlu menekan butang. Dalam masa yang pendek, mesej auto akan dihantar.

Sebahagian besar daripada projek ini adalah untuk menulis kod sumber dengan menggunakan bahasa C bahawa modul GPS dan GSM modem boleh disambungkan bersama dan berfungsi dengan baik. Apabila modul GPS menerima maklumat tentang longitud dan latitud, maklumat akan dihantar ke modem GSM. Kemudian, modem GSM akan menghantar mesej kepada pengguna sebagai satu matlamat penerima.

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LIST OF ABBREVIATIONS

GSM	-	Global System for Mobile Communication
GPS	-	Global Positioning System
PIC	-	Peripheral Interface Controller
TX	-	Transmitter
RX	-	Receiver
UART	-	Universal Asynchronous Receiver Transmitter
USART	-	Universal Synchronous/Asynchronous Receiver Transmitter
TTL	-	Transistor- Transistor Logic
SMS	-	Short Message Service
SIM	-	Subscriber Identity Module
RFID	-	Radio Frequency Identification
CDMA	-	Code Division Multiple Access
AT	-	Attention
2D	-	Two Dimension
3D	-	Three Dimension

CPU	-	Central Processing Unit
MCU	-	Microcontroller Unit
PC	-	Personal Computer
PCB	-	Printed Circuit Board
RF	-	Radio Frequency

CHAPTER 1

INTRODUCTION

This section gives an overview about the project such as idea of the project and the project's background.

1.1 Background Of Study

GPS is a wonderful technology with many applications in our society. It is common for drivers nowadays to use GPS to go their destination. Without GPS, they have to use map. The function of GPS is not only to know the direction of specific places, but it can also be used as tracking device. Generally tracking is observing persons or objects on the move and supplying a timely ordered sequence of respective location data to a model [14]. This project is not to observe a person but to provide the information such as longitude and latitude where the person. This information will be given when the system is activated.

Normally this project is necessary when the persons are in the critical situation such as when the snatch theft happened. Besides that, this project can also benefit those who want to enter into the huge jungle. When they are lost, they can send critical information to the authority or anyone as long as the device can transmit signal. However, because this project uses line from base station, the signal is quite limited in certain areas only.

1.2 Basis Of Project

The idea of this project is to have a transmitter that will activate the PIC that already attached with the GPS module. The information gathered and will be sent via SMS to the other person.

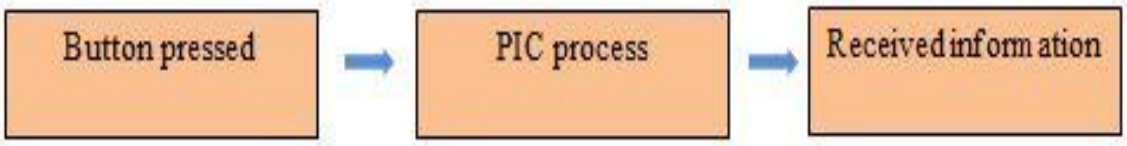


Figure 1.1: Basic Block Diagram of the Emergency Notification System

1.3 Problem Statement

Nowadays, many cases of snatch theft occurred in our country and it becomes the serious issues. There are lots of articles in the newspapers and on the internet to show the seriousness of the offence of snatch theft. On January 30th 2005, our nation's leading newspapers, namely Berita Minggu and The Star had reported snatch theft crimes, which had happened near Ipoh, Perak. The suspect had snatched the bag from a sixty year old woman at a shopping mall at Jalan Kampar, as the woman was walking to her car. The twenty years old thief, who had tried to escape in his car, also knocked down a man, who suffered minor injuries. The suspect ran through the traffic lights and collided with two cars. This has caused him to lose control of his vehicle, which then hit the road sign. The suspect then was detained [17].

According to the statistic of the theft in Malaysia, snatch theft has recorded the third highest of the theft cases in Malaysia. It has been recorded from year 2000 until year 2006. The snatch theft were seeing drop since year 2003, from 15798 cases to 9551

cases in 2006, or equivalent to a drop of 39.5% [15]. Because of that situation, it is necessary to develop a system that can alert someone about the snatch theft incident by sending a short message (SMS) by pressing one button.

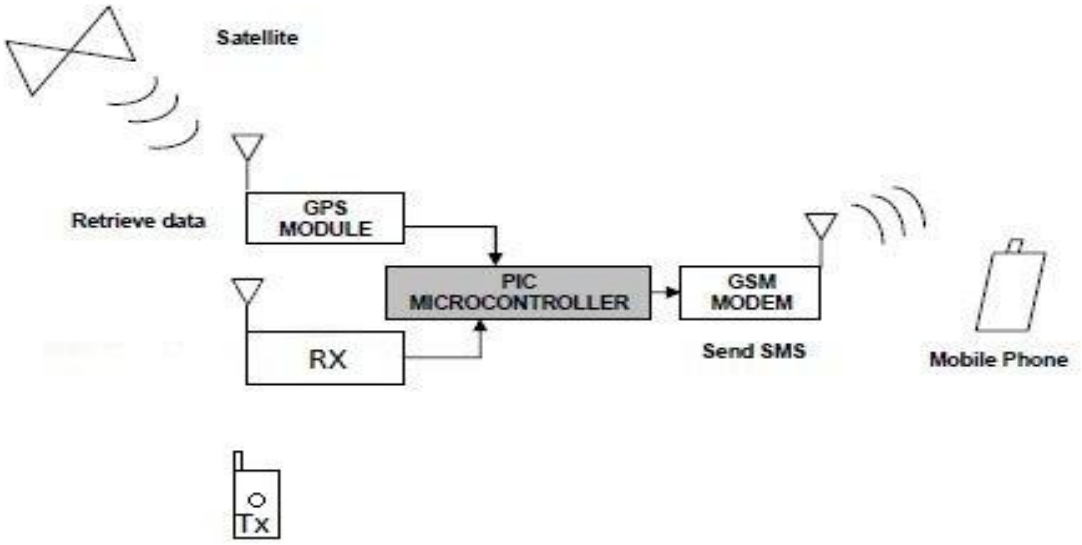


Figure 1.2: System Diagram

1.4 Objective

The objective of this project is to design an alert system which can send a short message (SMS) about an emergency that had occurred. Referred to the figure 1.2 above, the detector is an emergency button (Tx) consist of transmitter and receiver (transceiver) which will activate the GSM based device and send emergency message that already programmed in the PIC. That person does not have to type any words, but just press the button and the message will be sent automatically.

1.5 Scope of Study

Figure 1.2 shows the block diagram for the system. It consists of four main components which are GPS module, transmitter and receiver (Rx and Tx), PIC microcontroller and GSM mobile. The transmitter (Tx) will be hold by the person that will be used to press the button when emergency occur. The signal will receive by the receiver (Rx) and it will be activated the PIC microcontroller. The PIC stores the data from GPS module and the transceiver. The data will be sent to the user via SMS using GSM mobile. The distance for emergency button (Tx) and Rx are limited less than 100m if it is in line of sight.

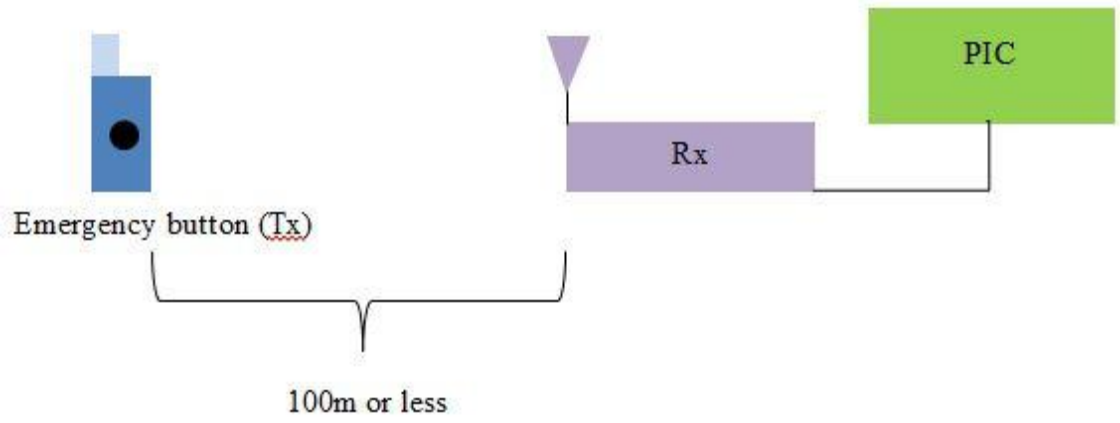


Figure 1.3: Distance between Tx and Rx

CHAPTER 2

LITERATURE REVIEW

Literature review consists of previous related to the project, information, articles and theories that make up the whole project. This chapter highlights the basic concepts and the fundamental theories of the part that will be used in the project. The parts discussed in the project are GSM mobile, GPS module, PIC microcontroller and mobile phone.

Besides that, this chapter will also explain the universal asynchronous receiver transmitter (UART) which is used at to connect the GPS and GSM, MAX232 and microC Pro.

2.1 Related Works

There are several studies have been done before to develop similar emergency system project. These previous projects can be used as references to develop methodology and instruments used with some modification.

The first project is from Khafidha Binti Adi Azahar [4] who designed RFID tagged services using GPS and SMS for tracking purposes. This project focused on tracking the packages brought by the delivery lorry. To make that possible, each package was tagged by RFID electronic tag. She used passive RFID instead of bar code

because RFID electronic tags do not require a visual scan and can carry significantly more information. Bar coding is almost everywhere these days, but it requires a close and accurate visual scan by a bar code reader. RFID tags on the other hand require only that the package be within radio frequency range of the RFID receiver or RFID interrogator.

The other previous work that is related to this project is Smart Vehicle Data Logger Using GPS and GSM. This project has been done by Wan Mohd Amir Haris Bin Wan Sallehuddin. The objective of this project is to store the data that from GPS to the memory card [2].

Next the commercial product that already widely used is panic alarm. Panic alarm is an electronic device designed to assist in alerting somebody in the emergency situations where a threat to persons or property exists. Normally panic alarm will used in critical system such as a nuclear weapon system. It is used to quickly activate an extreme measure to mitigate an emergency situation. Panic alarm has a unique system. This system can be used with elderly and vulnerable family member. The system will dial out up to 3 programmed telephone contact after a button is pressed [2]. Refer to appendix A for complete user manual of the panic alarm.

Figure 2.1: Phone Dialing Panic Alarm [16]

2.2 GSM Modem

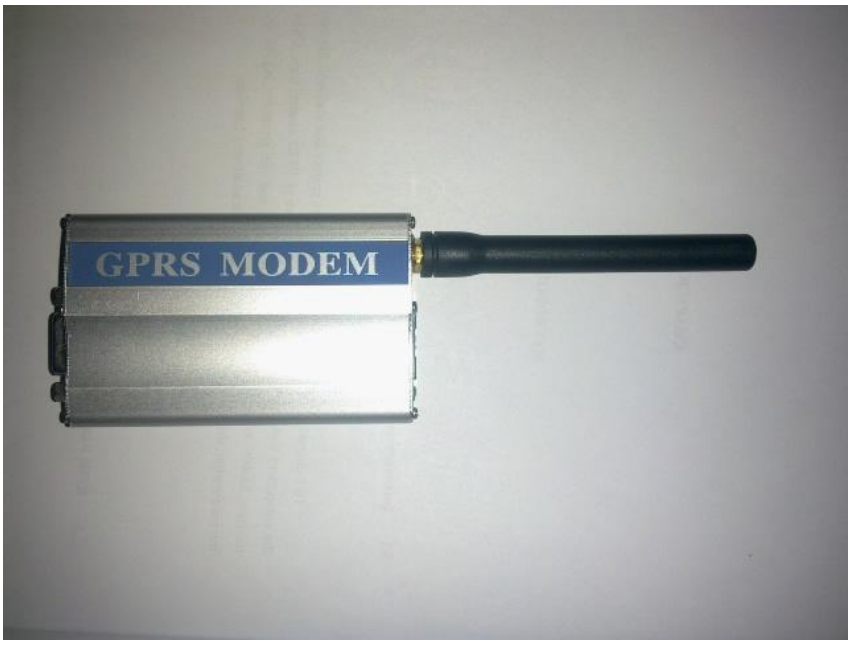


Figure 2.2: GSM Modem

GSM stands for Global System for Mobile Communications and is the most popular mobile phone standards commonly used in the world [13]. Normally GSM modem has built in antenna and has a slot. The function of that slot is to insert the SIM card. This SIM card is used to get the signal from telecommunication provider such as Celcom, Maxis and Digi. GSM modem also can be found in the mobile phones as long as the mobile phone is using GSM and not CDMA.

The GSM Modem terminal uses a specific programming language, or a set of commands called AT Commands, from the HAYES AT commands, created by Dennis Hayes[7]. AT stands for attention which means the commands will attract the modem's attention. Besides modem mobile, HyperTerminal also use the AT command.

There are a lot of AT commands that can be used to for the GSM modem. But for this project, the commands that will be used are only focus on sending and receiving text message only. The software that will be used to implement the AT commands is PIC Basic Pro. The table below shows several of the AT command.

Table 2.1: Examples of the AT command for SMS

AT+CMGS	To send a text message
AT+CMGR	To read a text message
AT+CMGD	To delete a text message

GSM function can also be obtained from mobile phone. It is because mobile phone is one of the GSM devices. But to make it function as GSM modem, it needs a lot of modification. Therefore, the used of GSM modem are more preferred.

There are some benefits of using this GSM modem such as:

i. GSM modem are low cost compared to mobile phone
ii. Easier to operate without doing any modification
iii. It is compact and have a nice look with the silver casing
iv. Easier to interface with the PIC
v. Have its standard power adapter with the standard power supply and come up with the modem cable.

2.3 Global Position System (GPS) Module

The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day [12]. To get the accurate longitude and latitude, the GPS receiver or also known as GPS modules in this project will use the concept of triangle to determine the exact location of the user or anything that attach to the GPS module.

The concept is called triangle concept because a GPS receiver must be locked on the signal of at least three satellites. So that the satellite can calculate the position of the GPS receiver in 2D position accurately. Normally the GPS used to monitor the motion of transports are in 3D view. To get that view, it must use at least four satellites. The function of GPS not limited to only calculate the position of the GPS receiver, it also can determine the speed, track, trip distance, distance to the destination, the shortest distance to the destination, sunrise and sunset time.

GPS also widely used in fleet system. It is a brilliant solution in order to increase the efficiency of the management of group of vehicle. [12] To build this system, digital maps, mobile communications and embedded system are combined in one system. This system has three parts which is localization and position module, communication module and CPU module.

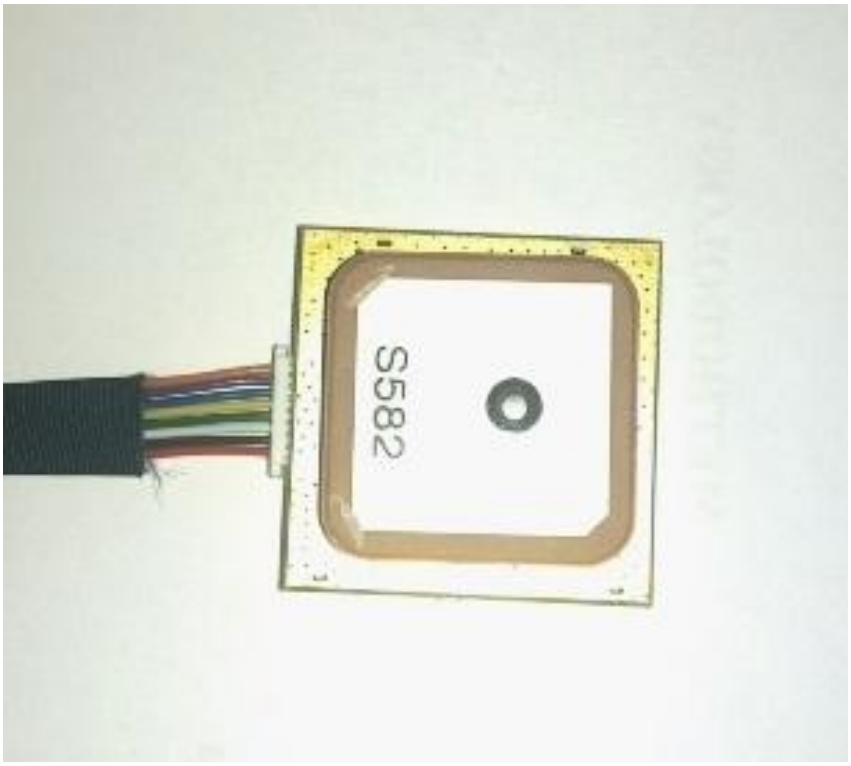


Figure 2.3: GPS module

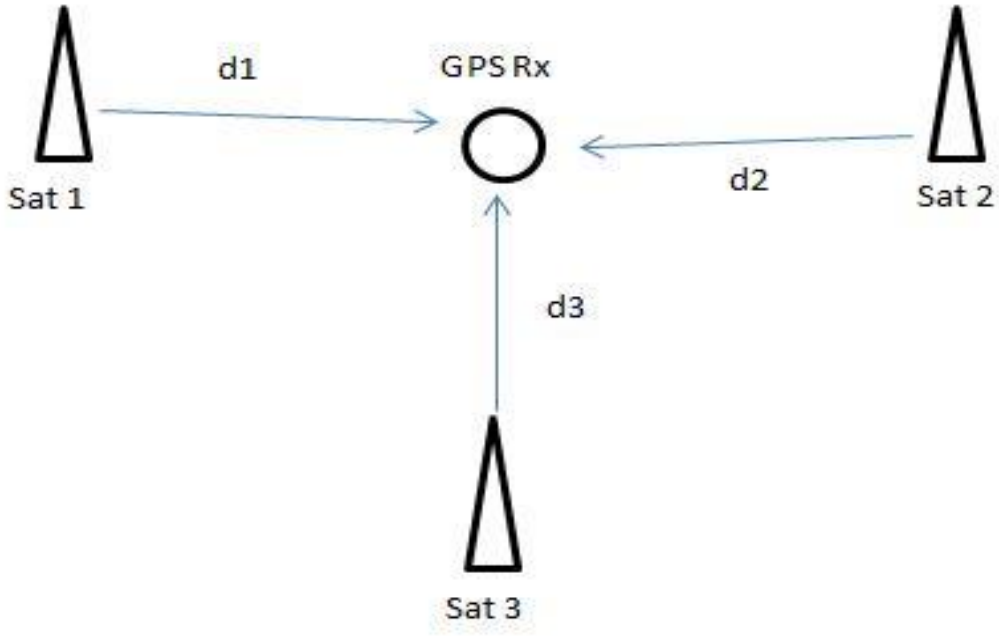


Figure 2.4: Basic Idea Calculation for Position

2.4 Microcontrollers

Microcontroller unit (MCU) or famously knows as microcontroller is a single chip microcomputer [10] are more used in the controlling system and animation of the machines. It does not depend on the size of the machine, as long as the microcontroller are suitable for that machine, the MCU will be used. This microcontroller is one of the technologies that have been developing to help the human to continue miniaturization of electronic hardware. There is a lot of microcontroller that has their own function such as PIC, Atmel AVR, Freescale Colfire and Intel 8051. Normally people like to use PIC or Atmel to do their project.

The main difference between PIC and Atmel is their function. PIC is to reduced instruction set computing which means the instruction can provide higher performance.

But for the Atmel it is complex instruction set computer based. Meaning that, a single instruction can execute several low level operations.

Besides that, PIC and Atmel comes from different manufacturer. For this project, using PIC is more suitable because PIC have built in analog to digital converter (ADC). This ADC is important for communication port because signal received normally in analog.

2.4.1 PIC microcontroller

PIC or peripheral Interface Controller is a type of microcontroller, product from Microchip technology. PIC is suitable used in wide range and have a lot of attractive features [10]. PIC has its own family that is define according to the pin. For examples is PIC 16 family, PIC 18 family and PIC 30 family. It also differentiates the maximum speed of the PIC, program memory size, maximum clock speed and the availability.

2.4.2 PIC16f877A

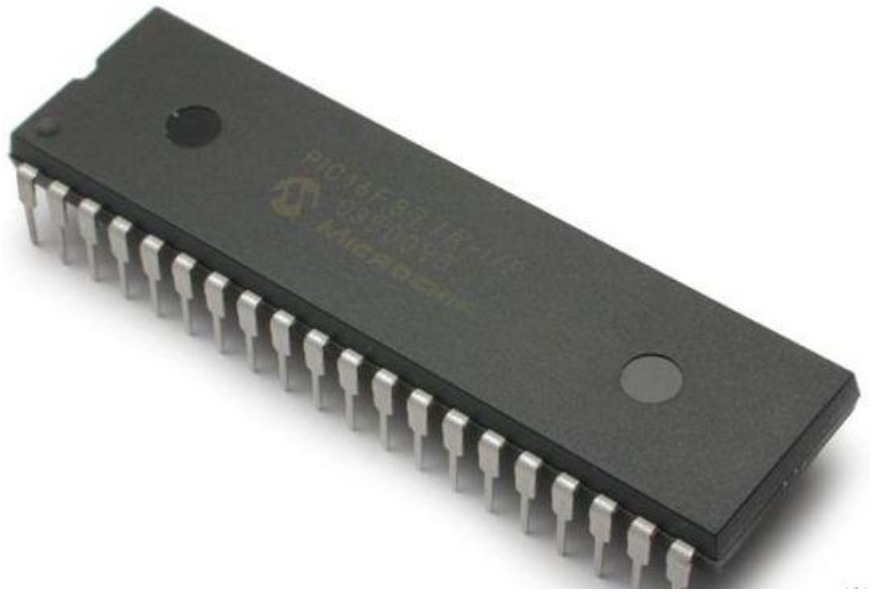


Figure 2.5: PIC16f877A

The pin instruction already attach at the Appendix C

The PIC16f877A contains of 8k Read Only Memory (ROM). This PIC can be program using pin PGM, PGC and PGD [8]. The number of instruction has been limited to 35 in the mid-range PIC. Therefore, it has been classified as reduce instruction set computer (RISC).

When the power down, the data will be stored in nonvolatile user memories block in the PIC MCU. For example, the data for secure code for smart card reader of code for an electronic. The PIC16F877A has 256 bytes for a block which is typical value.

2.4.3 Universal Asynchronous Receiver Transmitter (UART)

UART is a communication port that built in the PIC. Normally UART will use max232 connection. Besides UART, there is another communication port that has similar function like UART which is USART. USART stand for Universal Synchronous/Asynchronous Receiver Transmitter. This serial connection are useful because it only use one or two wire that carries signal for a parallel bus plus control compared with another serial that used at least eight data lines. This USART connection only needs three wires which is data send, data received and ground wire. So there is no separated clock signal is needed. Because of that, it is called asynchronous [3].

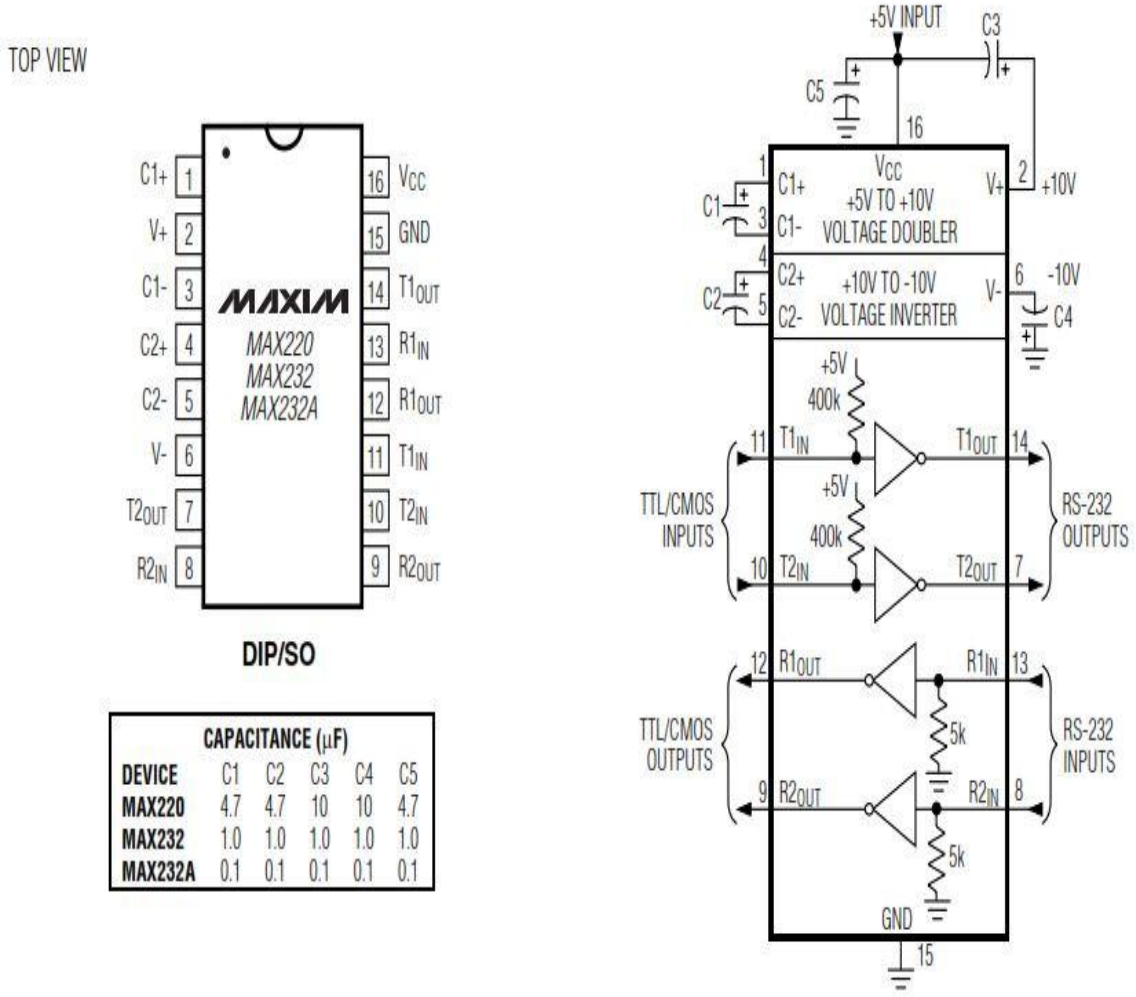
Not all the PIC will come up with UASRT or UART port. Because of that, using some simple programming, we can define any input output pin to be UART port. It is called software UART.

2.4.4 MAX232

MAX232 is widely used in order to convert signal from serial port to a signal that suitable use in TTL (transistor- transistor logic). MAX232 normally use in portable computers, mow power modems, interface translation and multidrop RS-232 network. MAX232 use no external component. That is why it is recommended where the space is limited in printed circuit board (PCB).

MAX232 used output voltage +5V and is required some external capacitor which are 1uF. The functions of the capacitor that attach to the MAX232 are as protection device. Besides that, capacitor also used to stabilize the input voltage.

When a MAX232 IC receives a TTL signal, it will convert the signal to the positive and negative value such as when the logic is 0, the TTL change the voltage from +3 to +15V and when the logic is 1, and the output voltage is -3 to -15V.



CAPACITANCE (µF)					
DEVICE	C1	C2	C3	C4	C5
MAX220	4.7	4.7	10	10	4.7
MAX232	1.0	1.0	1.0	1.0	1.0
MAX232A	0.1	0.1	0.1	0.1	0.1

Figure 2.6: Pins Configuration and Typical Operation Circuit for MAX232

2.5 Software Development

There is a lot of software that can be used to program the PIC. For examples are MPLAB IDE and MicroC Pro. These two programs are basically used to program the PIC and also change the command into the Hex format.

2.5.1 MicroC Pro

MicroC Pro is one of the product produce by Microchip. It is a full- featured ANSI C compiler for PIC and a best solution to develop coding for the PIC. It provides examples along with tutorial, thus learning the coding process becomes easier. Compared to the MPLAB, the coding quit lent because of all the parameters must be defined first. But the MicroC Pro is simpler. The programming process not only easy, but it has shorter coding which have the same function as the command in the MPLAB [].

The main function of the designing the MicroC Pro is to provide the programmer with the easiest possible solution in order to develop applications for embedded system. Besides that, the performance of the system also maintained while using this software.

There are a lot of improvements have been done in the IDE for MicoC Pro. Some changes have done to make this software more compatible compared to IDE MPLAB. For example, this software have fixed the error in Code explore. Normally code explorer will define error if there are no brackets “()” put after void command, but with this MicroC Pro, there is no error if there are no brackets.

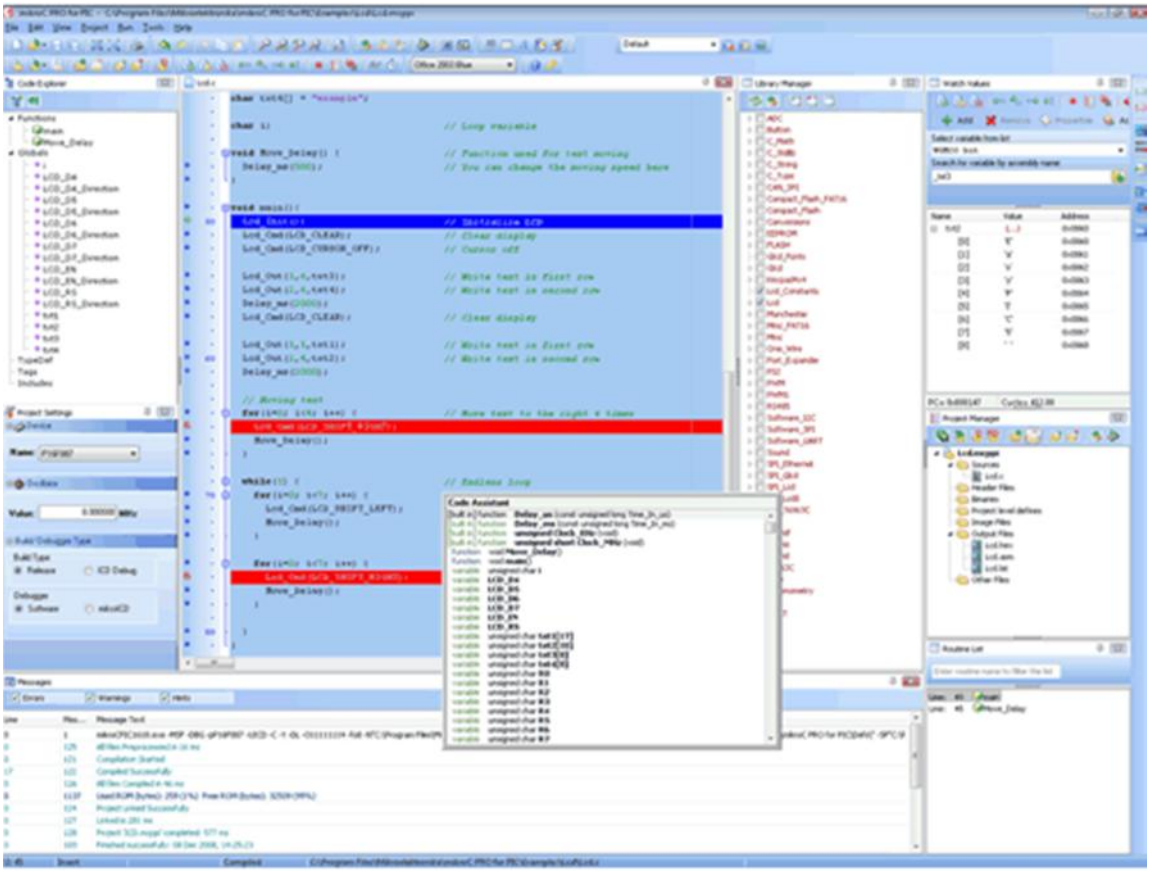


Figure 2.7: MikroC PRO for PIC IDE

2.6 Radio Frequency (RF) Transmission

The distance may be short (remote control) or long (normally radio communication that involve thousand kilometers). The range for radio frequency is from a few ten hertz until gigahertz.

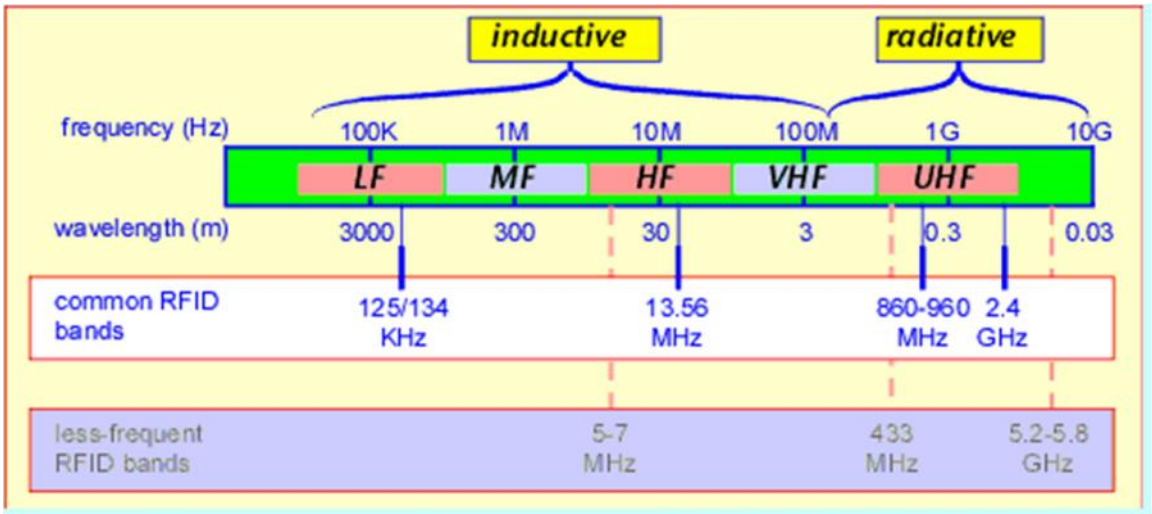


Figure 2.8: Frequency Band

From the figure above, the radio frequency starts from 100MHz until 10GHz. That frequency are standardize to the entire world. The frequency above is also known as ISM (industrial, scientific and medical) band. This frequency is standardizing by ITU-R. ITU-R is one of the sectors in International Telecommunication Union.

CHAPTER 3

METHODOLOGY

This chapter explains more on procedures and process of the overall project that's related to the objective of the project.

3.1 Problem Identification and Analysis

Before the project can be started, the first thing that needs to do is to identify and analysis the problem exist. Problem identification may refer to the challenges or problems which will be faced while doing the project, and may affect objectives of the project. After deciding the suitable title for the project, I have to analyze whether this project can help the community or not. Besides that, I have to understand the importance of integrating the whole system, so that, the objective of this project can be achieved.

3.2 Preliminary Research

Preliminary research is the important part of this project. Preliminary research can also be called as the backbone of the project. Extensive researches related to this project are needed to gain sufficient knowledge and strong understanding about the project. Preliminary research is ongoing and done in every stages of developing this project.

The first stage of the research includes the finding on the information needed so that the objective can be achieved. Besides that, the research also covers the literature review from journals, books, and internet that will support to understand more on this project especially the information about the GPS, modem mobile and PIC microcontroller.

3.3 Components and Tools Identification

The main component to build up the system of this project are GPS module that act as GPS receiver, modem mobile, mobile phone that will receive all the information sent and PIC microcontroller that will process all the gathered information.

3.3.1 Protoboard

Protoboard or also known as breadboard is a board that normally used in the electronic first design circuit. The construction of the breadboard is based for prototyping of the electronic. Solder less breadboard is the term that normally used to be referred to this breadboard. For this project, the circuit is being tested using breadboard and after the entire components are working well, the circuit is fabricated.

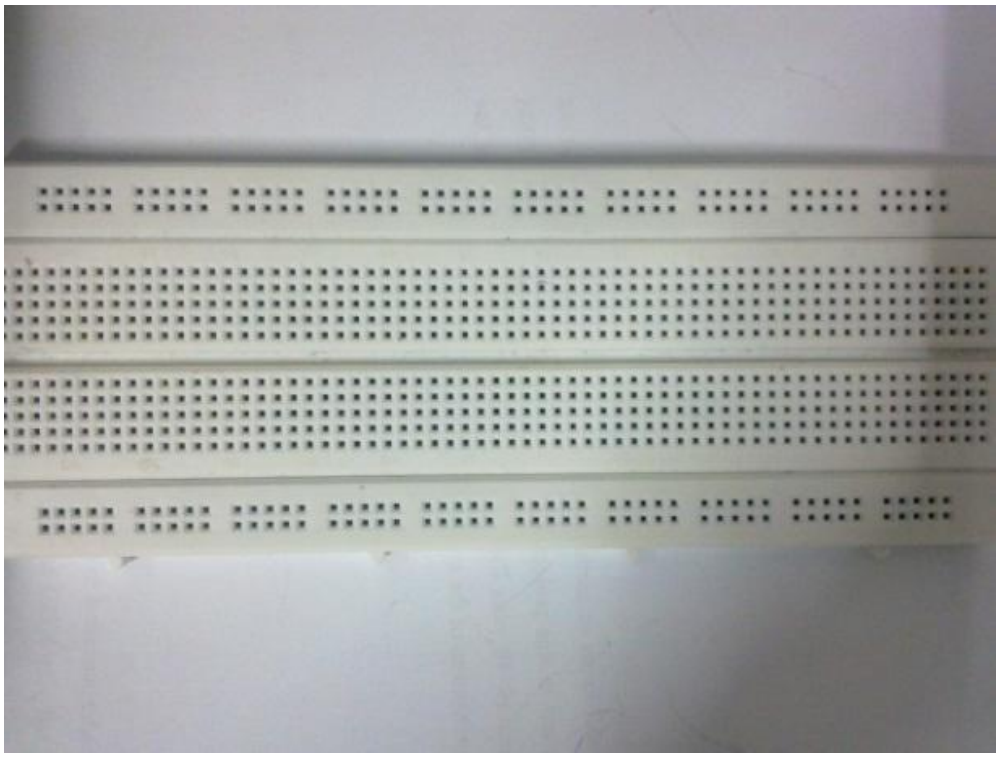


Figure 3.1: Breadboard

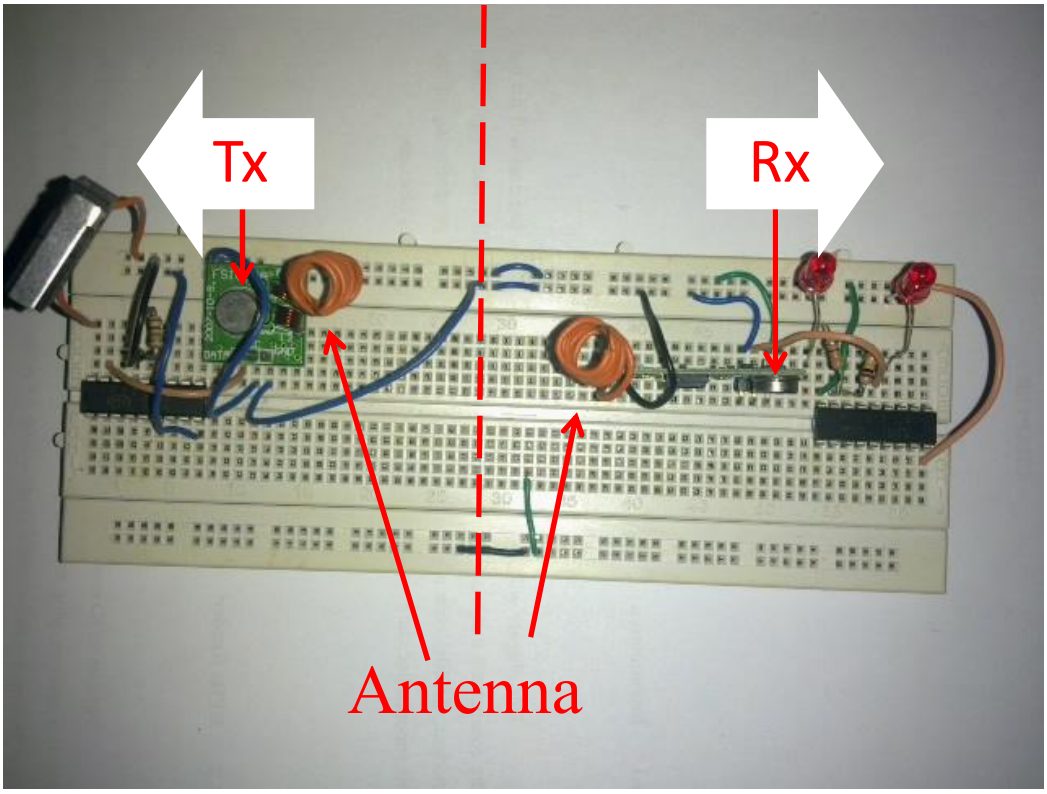


Figure 3.2: Breadboard with Completed Transmitter and Receiver Circuit

3.3.2 Transmitter and receiver module

In this project, the transmitter and receiver must use the same frequency. There are only two frequencies provided by Cytron which is 315MHz and 433MHz. For this project, the frequency use is 433MHz. This RF transmitter and receiver are very small in dimension. Besides that, it has wide range of voltage (3V- 12V). This low cost transmitter and receiver can be used up to 100 meters (the antenna design, working environment and supply voltage will seriously impact the effective distance). This RF module can receive both in digital and serial manners.

This RF module comes without antenna. The length of antenna is depending on the frequency used. For this module, the length of antenna is 18cm.

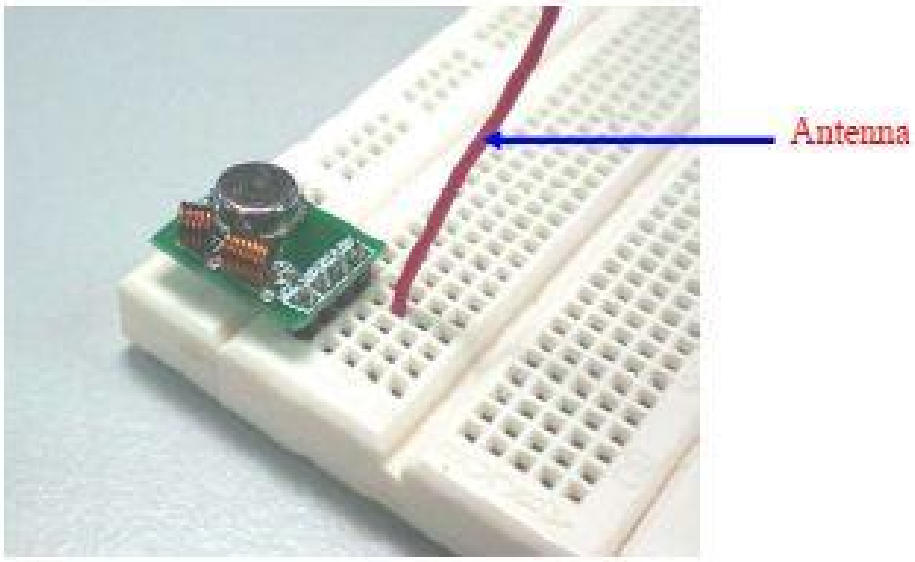


Figure 3.3: The Length of Antenna Is 18cm

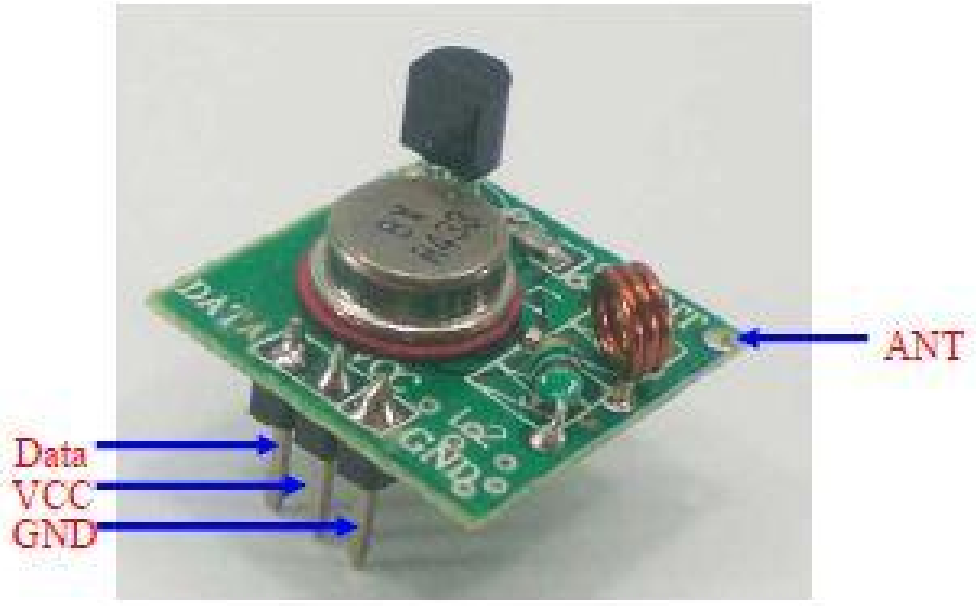


Figure 3.4: Transmitter Module 433 MHz

Table 3.1: Description Transmitter Pin

Label	Description
Data	The Data pin of the transmitter
VCC	The power supply of the transmitter
GND	The ground of the transmitter
ANT	The hole to solder and connect antenna)

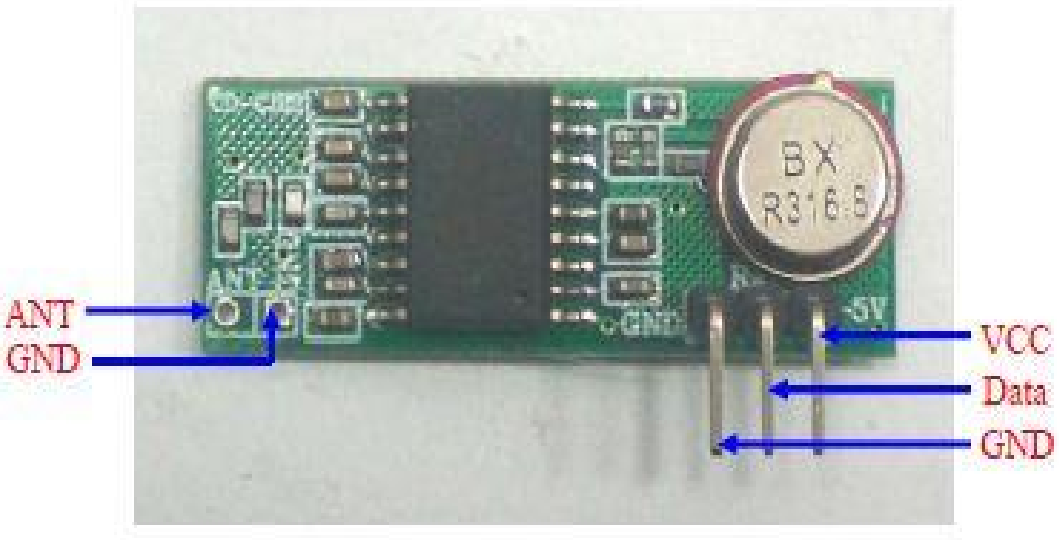


Figure 3.5: Receiver module 433MHz

Table 3.2: Description Receiver Pin

Label	Description
Data	The data pin of the receiver
VCC	The power supply(5v) to the receiver
GND	The ground of the receiver. (2 GDN are internally connected each other)
ANT	The hole to solder and connect antenna)

3.3.3 Decoder and encoder

This pair of transmitter and receiver comes with pair of decoder which is PT2262 for transmitter module and PT2272-L4 for receiver module. This decoder also has its own value of resistor that act as oscillator.

Table 3.3: Value of Oscillator Resistor

PT2262	PT2272
4.7MΩ	820KΩ *
3.3MΩ	680KΩ *
1.2MΩ	200KΩ **

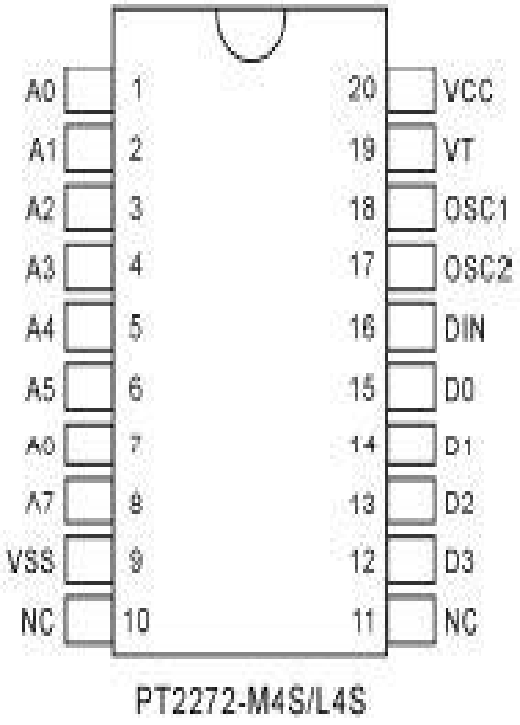


Figure 3.6: Pin of the Decode

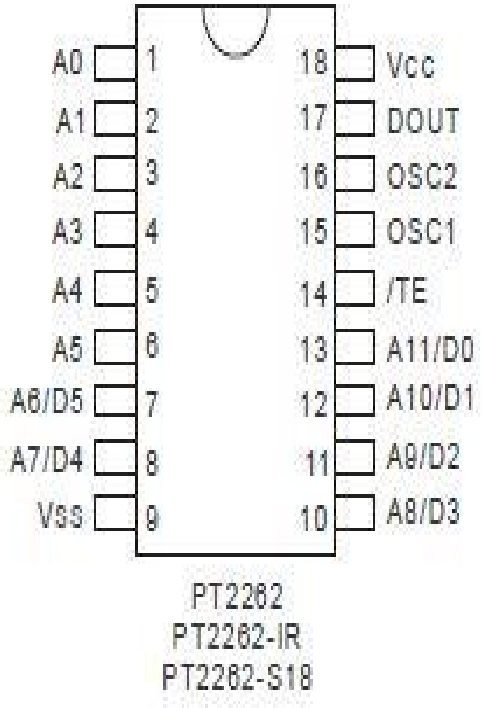


Figure 3.7: Pin of Encoder

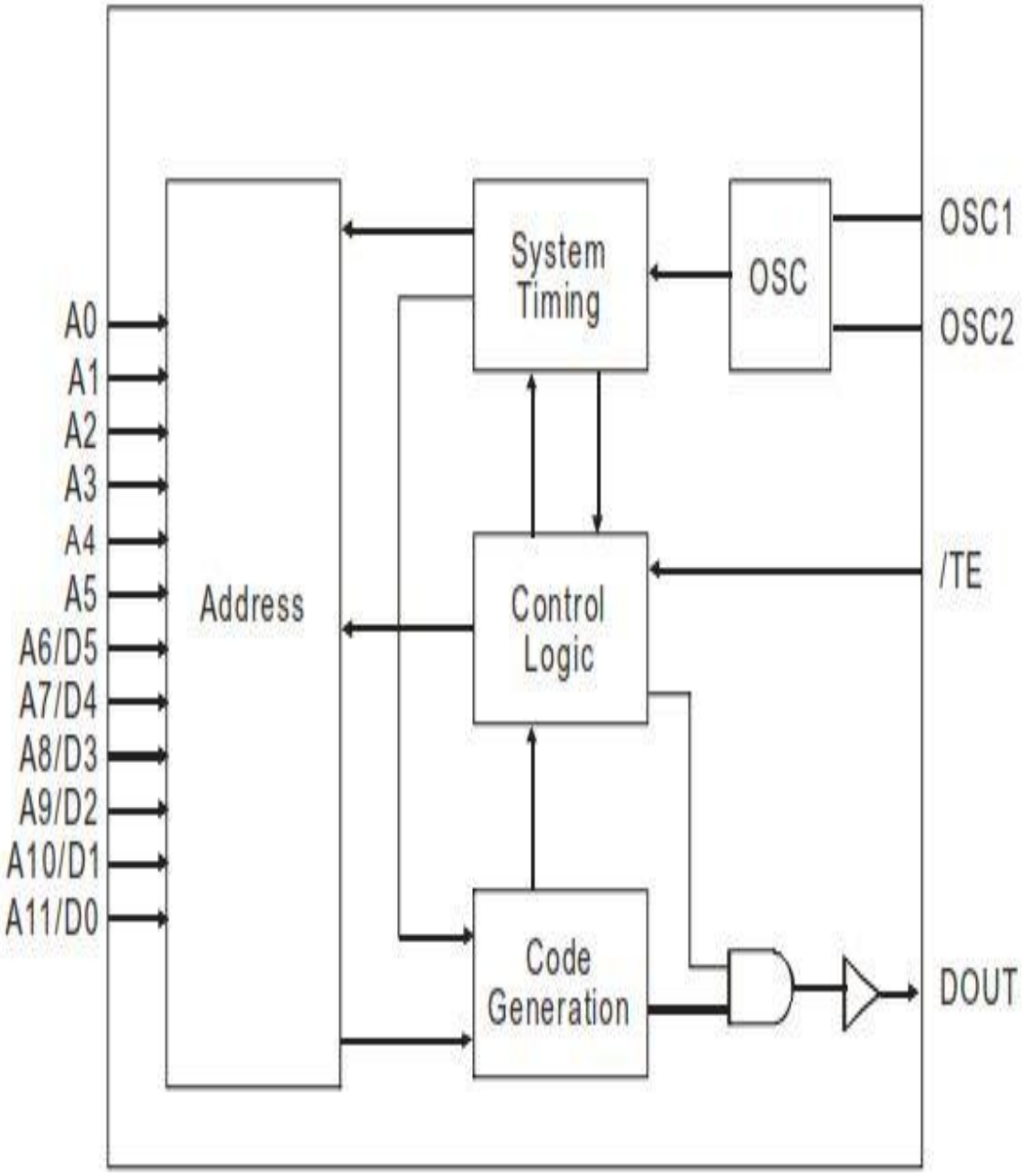


Figure 3.8: Block Diagram for Decoder PT2272

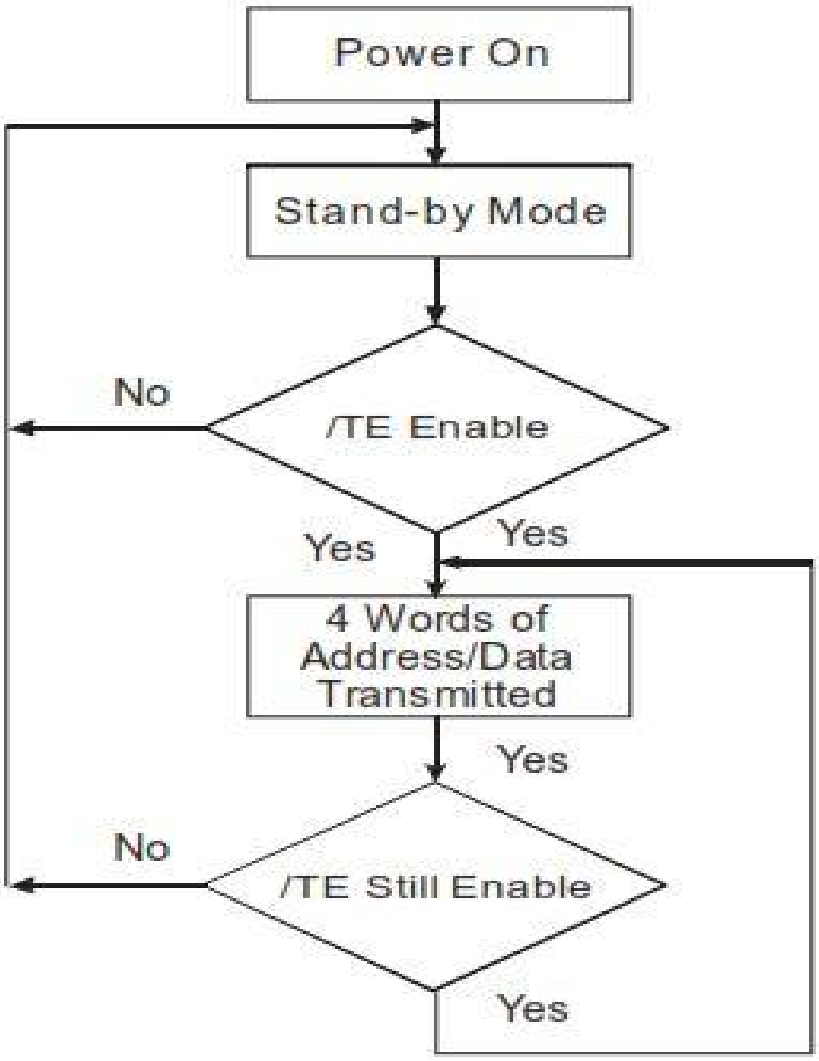


Figure 3.9: Flow Chart Diagram for PT2272

Flow chart in figure 3.8 explains about how the decoder PT2272 operates. First, when the power is ON, the decoder is in standby mode. After PT2272 received input 1, it will enable the transmission of the data. But, if the decoder does not received input 1, it will maintain in the standby mode. After the transmission is enabled, the data from the input port will be sent. These steps will continue as long as the transmission port is enabled.

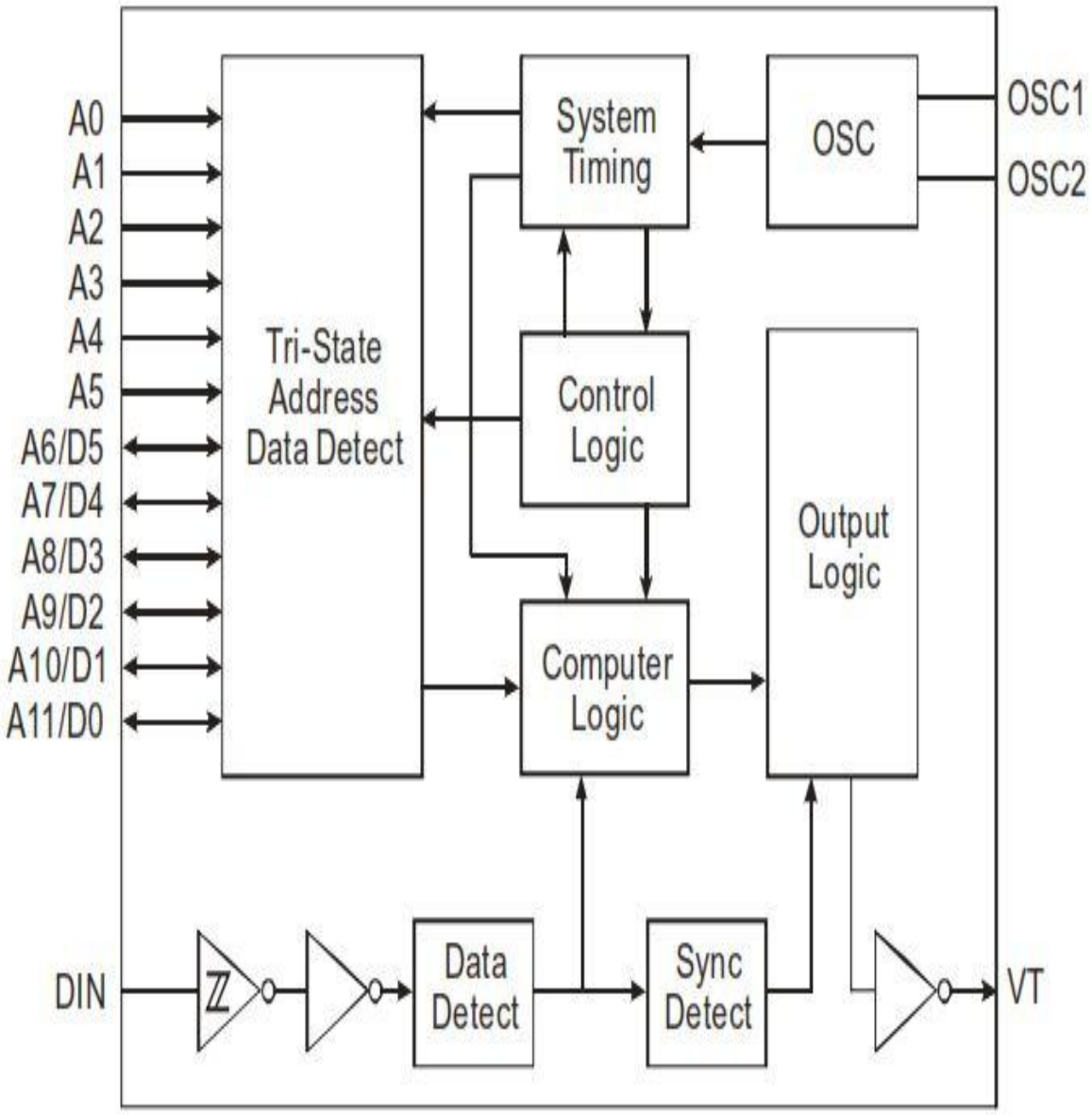


Figure 3.10: Block Diagram for Encoder PT2262

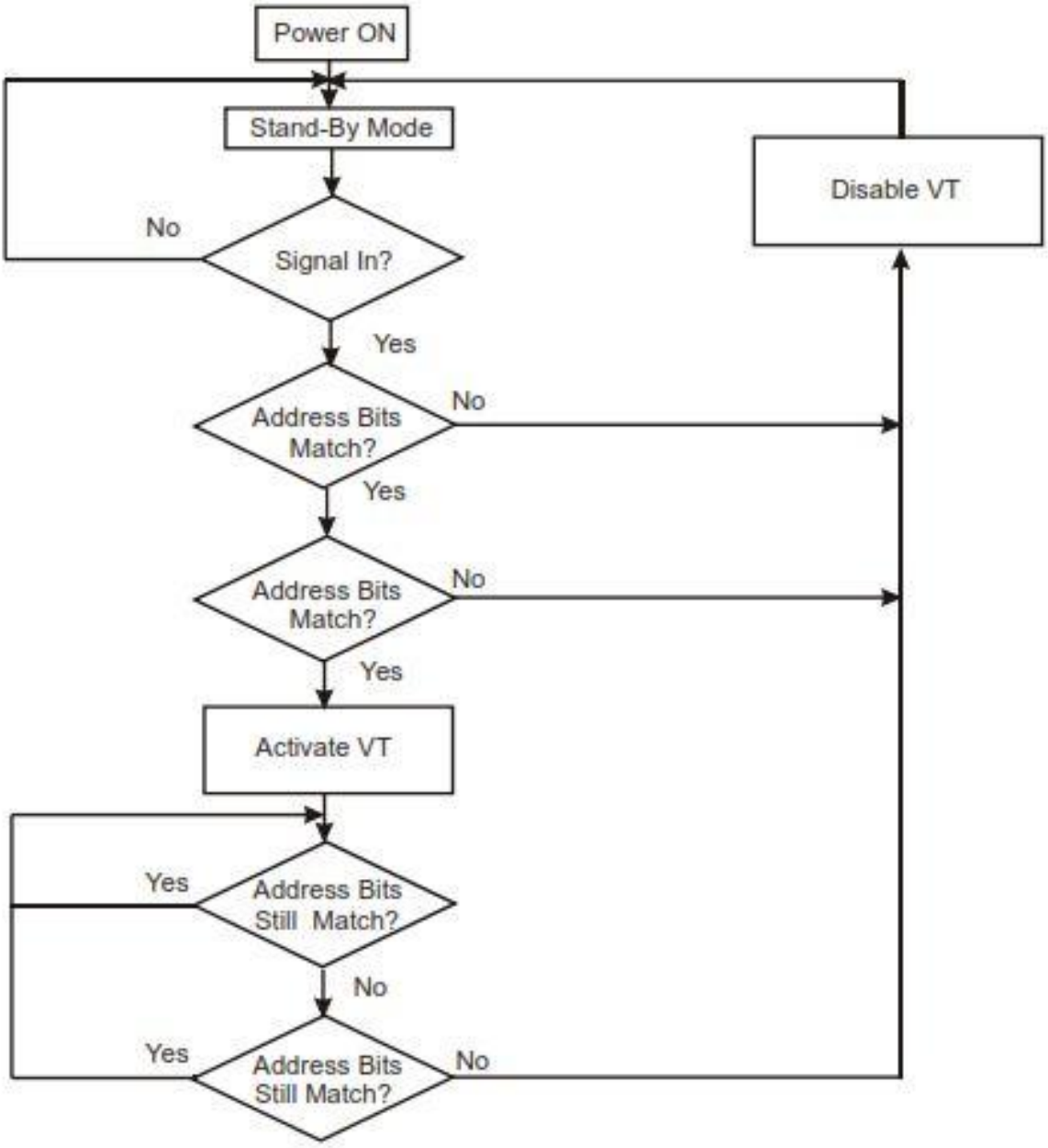


Figure 3.11: Flow Chart Diagram for PT2262

Figure 3.10 above describes the operation of the encoder PT2262. The first step is similar to the decoder PT2272 which is in standby mode if there is power supply connected to it. Then this encoder will wait the signal from decoder PT2272. If there is no signal coming in, it will continue in standby mode. After the encoder received the signal from decoder PT2272, it will read the address sending in. if the address received

is different, it will disable the VT (valid transmission). Then, the encoder will enter in the standby mode again. After the address receives is match with the encoder's address, it will enable the VT. The process of matching the address will continue until all bits are correctly sent.

After all the specification is chosen, the transmitter and receiver circuit can be design and constructed.

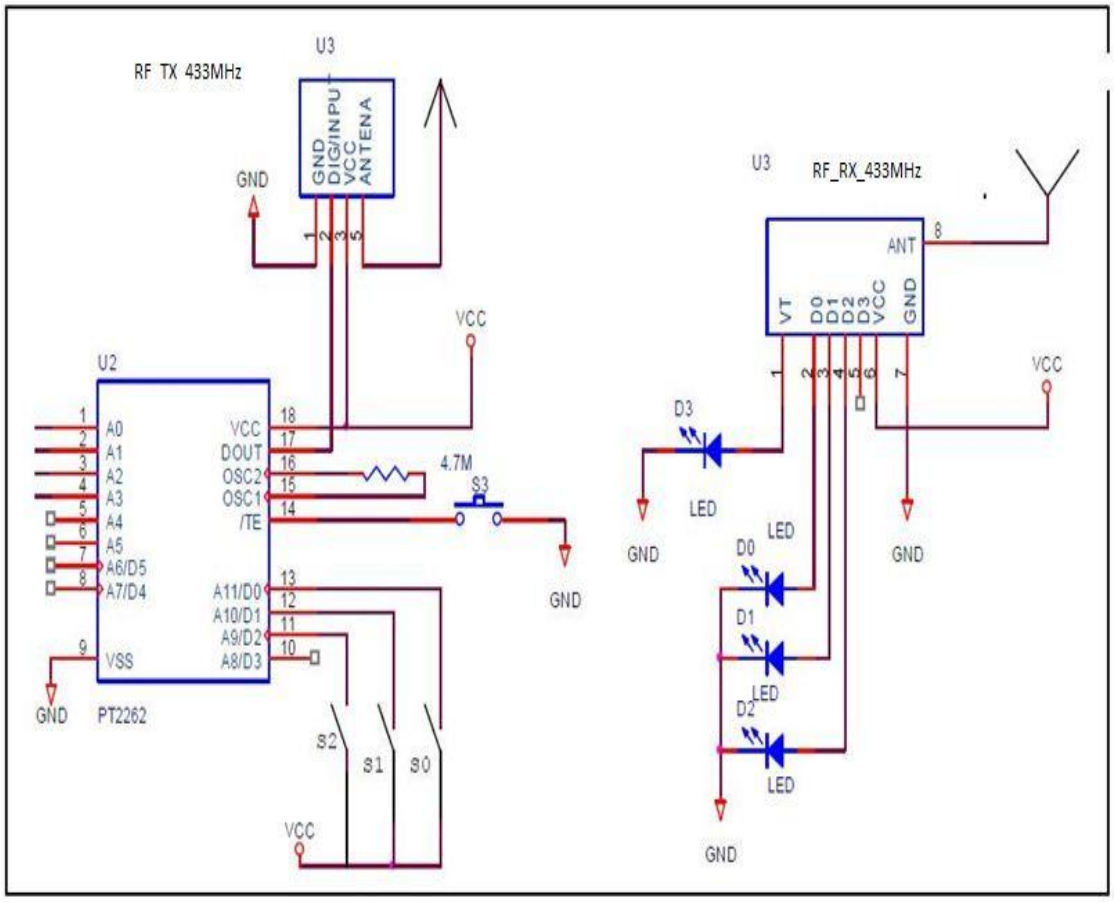


Figure 3.12: Schematic Diagram for Transmitter and Receiver

3.3.4 Testing result for transmitter and receiver circuit.

Even though this project only use this transmitter and receiver circuit just to trigger the PIC, but it is still need to be tested so that we know this circuit are functioning well and can be act as wireless switch [1]. It is also known as remote.

Table 3.4: Testing Result

TRANSMITTER			**RECCEIVER**		
S0	**S1**	**S2**	**D0**	**D1**	**D2**
0	0	1	0	0	1
0	1	0	0	1	0
0	1	1	0	1	1
1	0	0	1	0	0
1	0	1	1	0	1
1	1	0	1	1	0
1	1	1	1	1	1

From the result above, it can say that, this transmitter and receiver circuit is working well. But for this project, we want to use only one output that can trigger the PIC to send the message. So we set S0 is high and the rest are low. Then, the D0 are connected to one of the I/O pin of the PIC.

3.3.5 Power Supply

To make the PIC function very well, it requires a suitable power source. Because of that, a power supply that has output voltage 5V is used in this project. The power supply is one type of the step down transformer. In this project the AC voltage are being step down to 5V DC voltage. If there is no power supply that can gives the output 5V,

we also can use 12V DC or 9V DC, but it required voltage regulator 5V to step down the voltage until 5V.

Figure 3.13: AC to DC Power Supply

3.4 GSM Modem

3.4.1 GSM Modem interface Description

1. This GSM has one serial port that used 3.3V TTL voltage level/ RS232 Voltage level optional with the bit rate 115200bps

2. The power supply for this GSM modem is 7.5V with 500mA using direct current (DC)
3. It has antenna interface so that it can received from the mobile station
4. It has a status light that indicates the power status. The red light will appear when the power is ON
5. It is come up with SIM card holder.
6. For the installation and checking the GSM modem, refer to the appendix A [5]

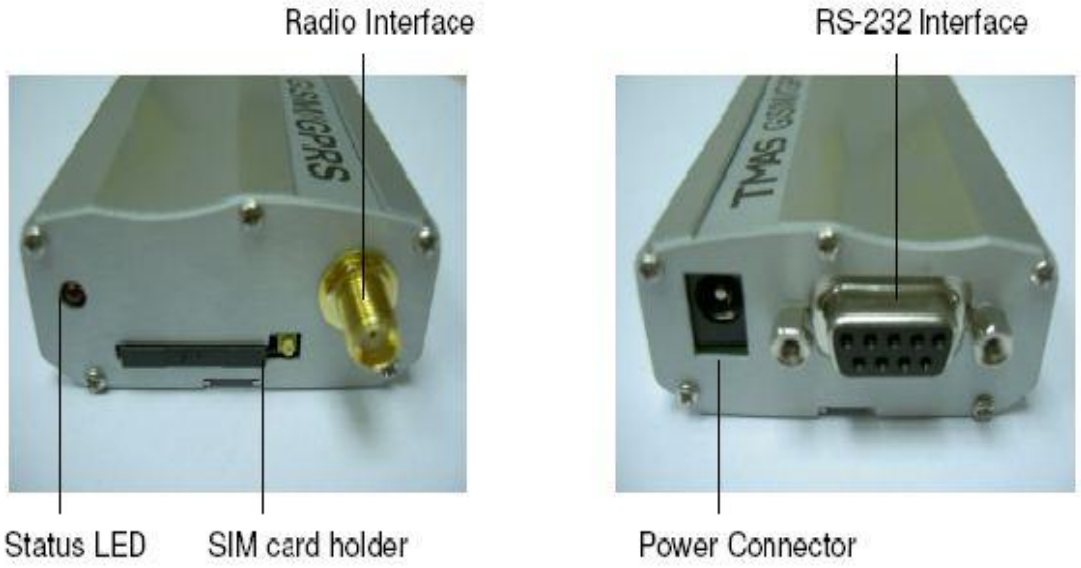


Figure 3.14: GSM Interface [6]

3.4.2 GSM RS-232 Interface

Figure 2.4 below shows the interface of RS 232 (D-SUB 9-pin female) of the GSM modem.

Figure 3.15: GSM RS232 interface

Table 3.5: GSM RS232 Pin Assignment

Pin no.	Signal name	I/O	Function
1	/DCD	O	Data Carrier Detected
2	/RXD	O	Receive Data
3	/TXD	I	Transmit Data
4	/DTR	I	Data Terminal Ready
5	GND	-	Ground
6	/DSR	O	Data Set Ready
7	/RTS	I	Request To Send
8	/CTS	O	Clear To Send
9	/RI	O	Ring Indication

3.4.3 SIM Interface

According to the GSM 11.12 phase 2, there is a SIM interface that's already intended for 3V SIM cards. A wire interface which is 5 wires already places in the GSM modem to interface the GSM modem with the card holder [3]. To put the SIM card or eject the SIM card, the button must be push.

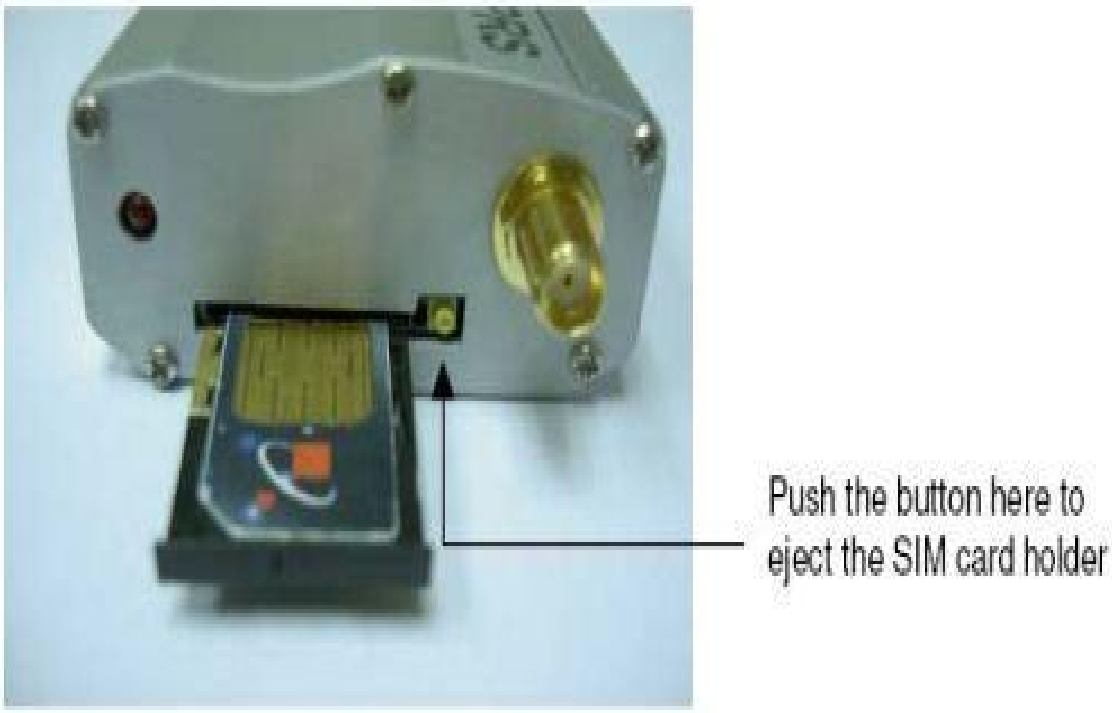


Figure 3.16: SIM Interface

3.5 MAX232

In this project, MAX 232 is required to convert the signal from RS232 port of GSM modem and GPS module to the signal that the PIC can read. The diagram below shows the schematic diagram for connection between MAX232, GPS module and GSM modem.

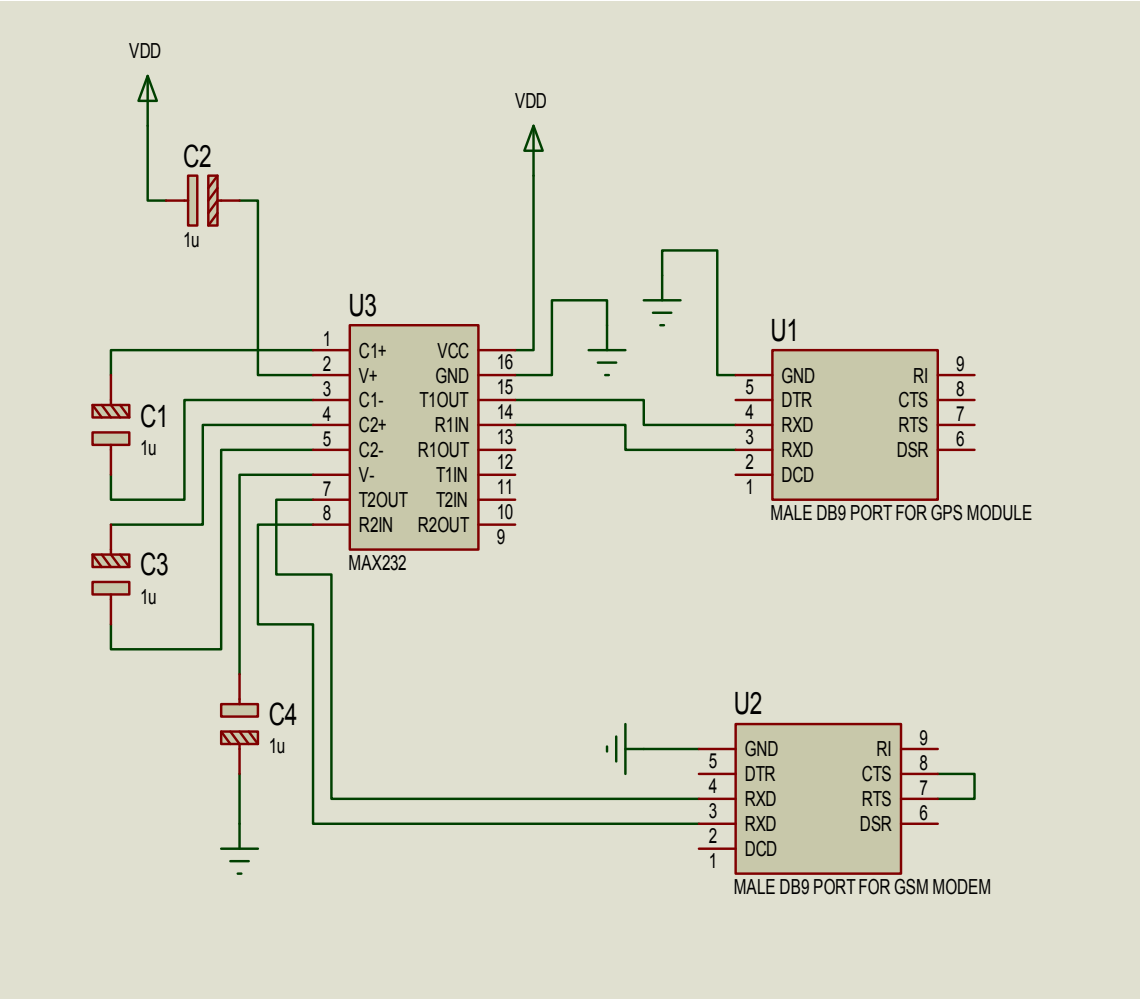


Figure 3.17: MAX232 connection

3.6 Flow Chart

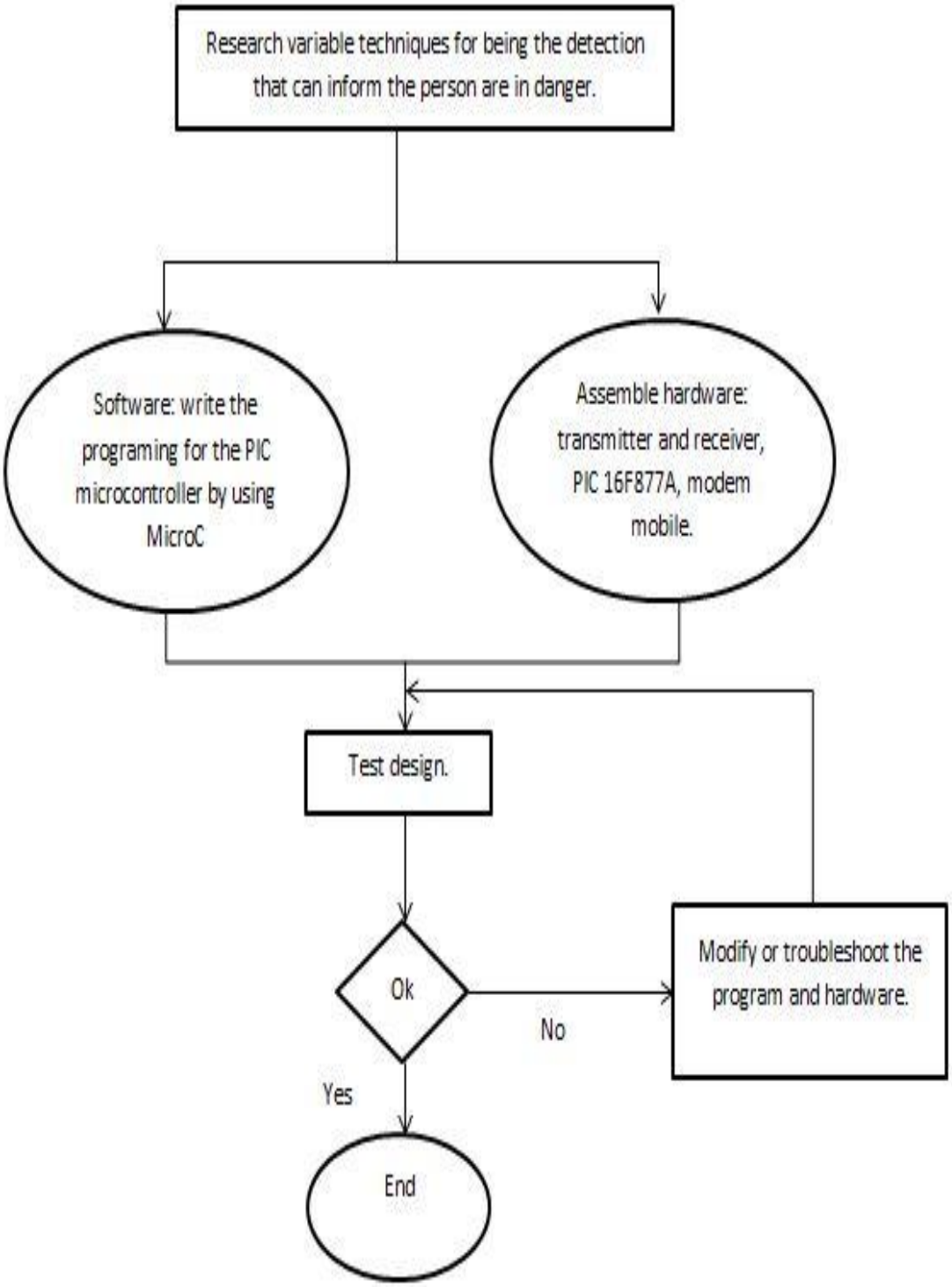

Research variable techniques for being the detection that can inform the person are in danger.
Software: write the programing for the PIC microcontroller by using MicroC
Assemble hardware: transmitter and receiver, PIC 16F877A, modem mobile.
Test design.
Ok
No
Modify or troubleshoot the program and hardware.
Yes
End

Figure 3.18: Methodology of Project

Figure 3.11 above shows the flowchart of the methodology to conduct the project. The first step is doing the search and study about the previous project or any other articles, relevant paper and publication that related to this project. This project can be divided into two parts which is software part and hardware part.

For the hardware part, it is important to know what types of components those want to be used in this project. For example is PIC microcontroller. Microcontroller is the most important part that will act like a brain of this system. It will control the system according to the program that already stored to it. While the software part are more on program the PIC by using C language. C language is the best in term of performance when compared with Java or other language. Besides that, the C language is not too difficult to learn in comparison to Java.

Next, the system must be tested after hardware part is done. If the system does not work, the system must be troubleshooted and the problem identified. The process will be repeated until the project is successful.

3.7 Gantt Chart

Gantt chart has been done to plan the process of this project. It is important to make sure the project can be done at the given time.

Table 3.6: Gantt chart for FYP -1

	week															
activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
meeting with supervisor																
confirmation of title and objective																
literature review																
submit project proposal																
understanding concept of wireless																
identify the hardware needed																
FYP seminar																
report writing																

Table 3.7: Gantt chart for FYP -2

	week																
activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
meeting with supervisor																	
identify component & circuit																	
programming learning																	
submit evaluation 1																	
run simulation																	
submit evaluation 2																	
trobleshoot																	
result analysis																	
seminar and demonstration																	
writing thesis																	

3.8 Expected problem

After doing some literature study, expected problem have been identified such as the limitation in distance and the size of the device. This is important to make sure that the project can be done smoothly without any difficulty because of minor or major problem.

In this project, the major problem is the limitation of the distance between the emergency button and the receiver (Rx) that attach with the PIC. The signal can be received by the RX if the distance between Rx and Tx are about 100m or less. The maximum distance that these devices can operate is 100m if the RX and Tx are in line of sight.

The second problem is the prepaid of the SIM card. Because of this project use the existing telecommunication provider such as Celcom, Maxis and Digi, the SIM card must have credit. So that, the message that already program in the PIC can be sent to the person though modem mobile.

Next is the size of transmitter. Because of the transmitter is always carried by person, so the size must as small as possible, so that, there is no one can know the location of the transmitter.

3.9 Software Development

3.9.1 MicroC Pro

The program for this project has been done using MicoC Pro. As said earlier, using MicroC Pro are more easily compared with MPLAB. Besides that, the program is also quite short.

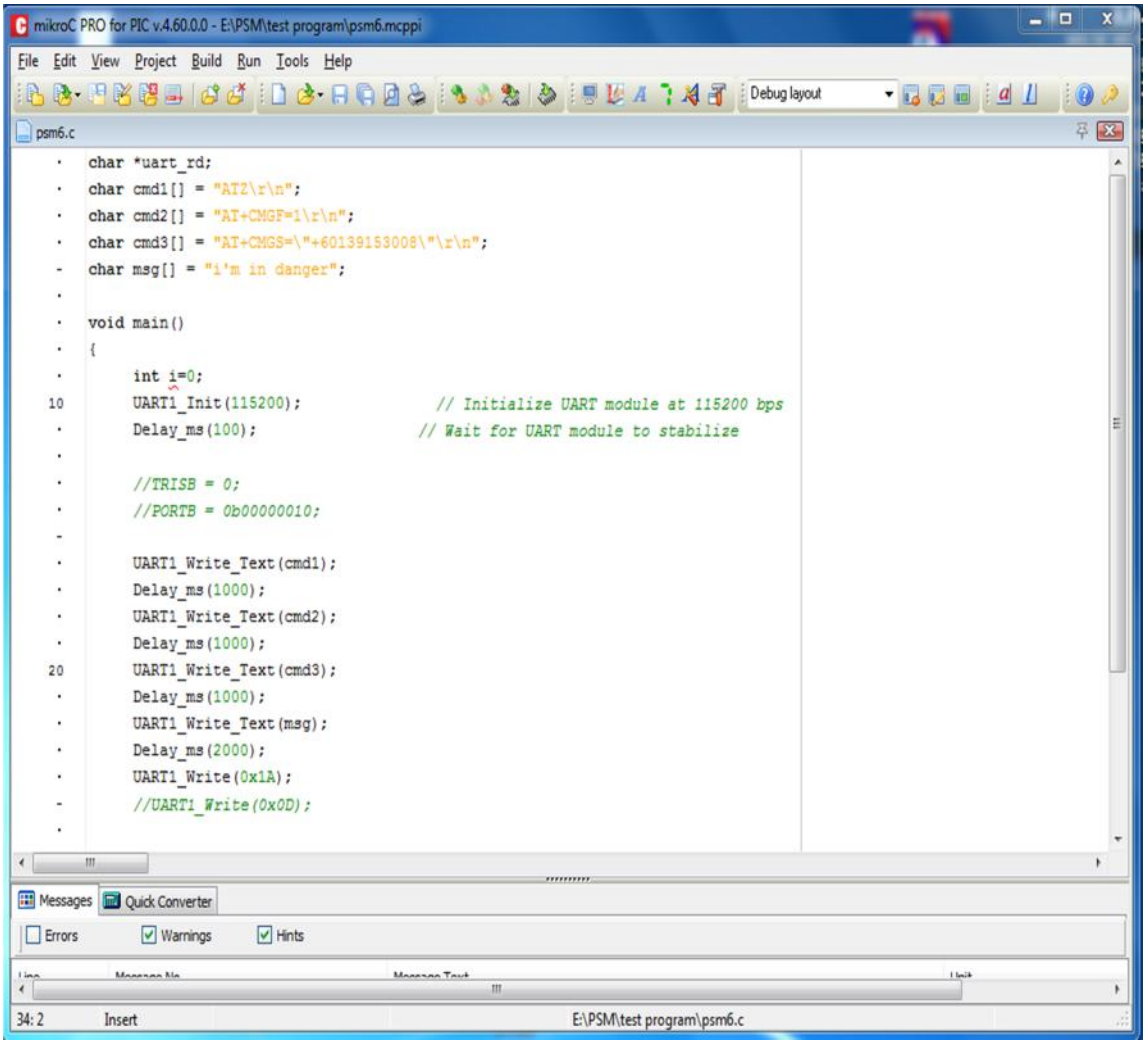


Figure 3.19: Coding using MicroC Pro

3.9.2 UIC00B

Because of this project does not used SK40C, so it requires UIC00B with the UIC-S to export the hex command into the PIC. This UIC00B is low cost and required six way serial programming. The connection of the UIC00B and UIC-S with the PIC already attach at Appendix D

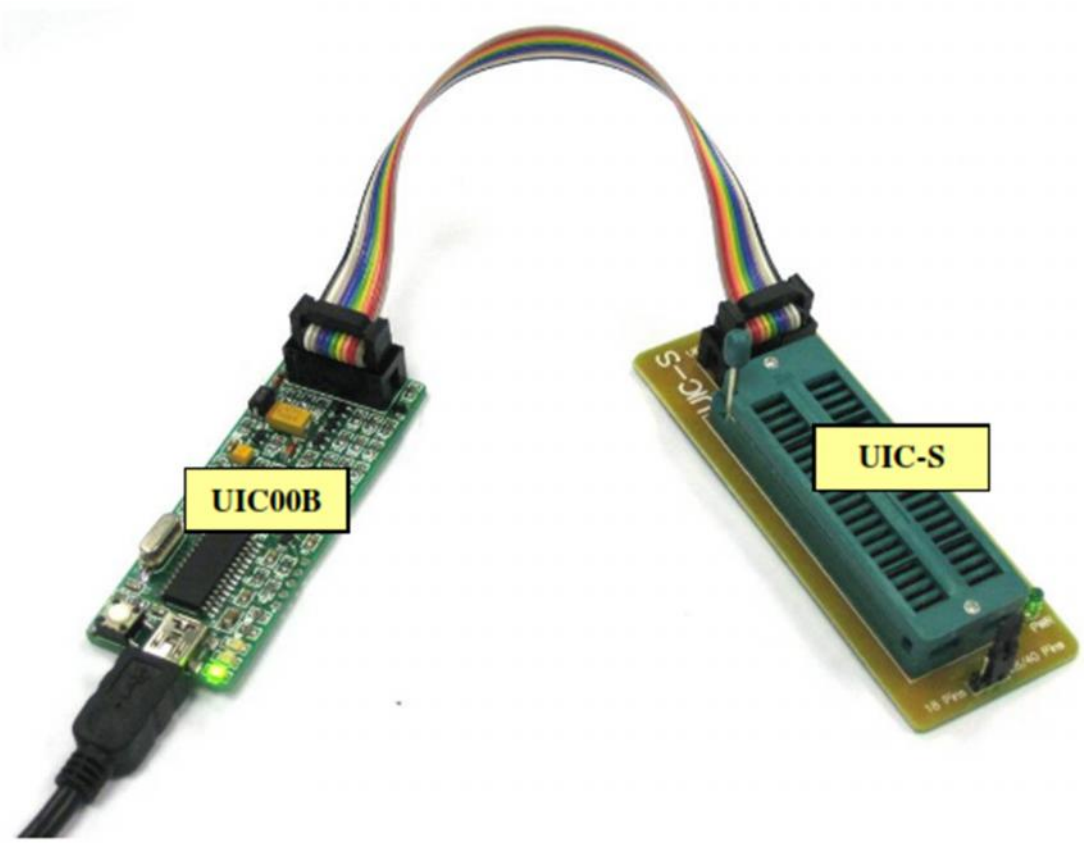


Figure 3.20: UIC00B and UIC-S

3.9.3 X-CTU

X-CTU is software provide by Digi. It is a windows- based application. This software has been design to test the RF product from Digi. Because of my project also used RF to send the data, so it is suitable for me to test the circuit and also the operation in the PIC using X-CTU. X-CTU can either download from Digi's web site or from the installation CD.

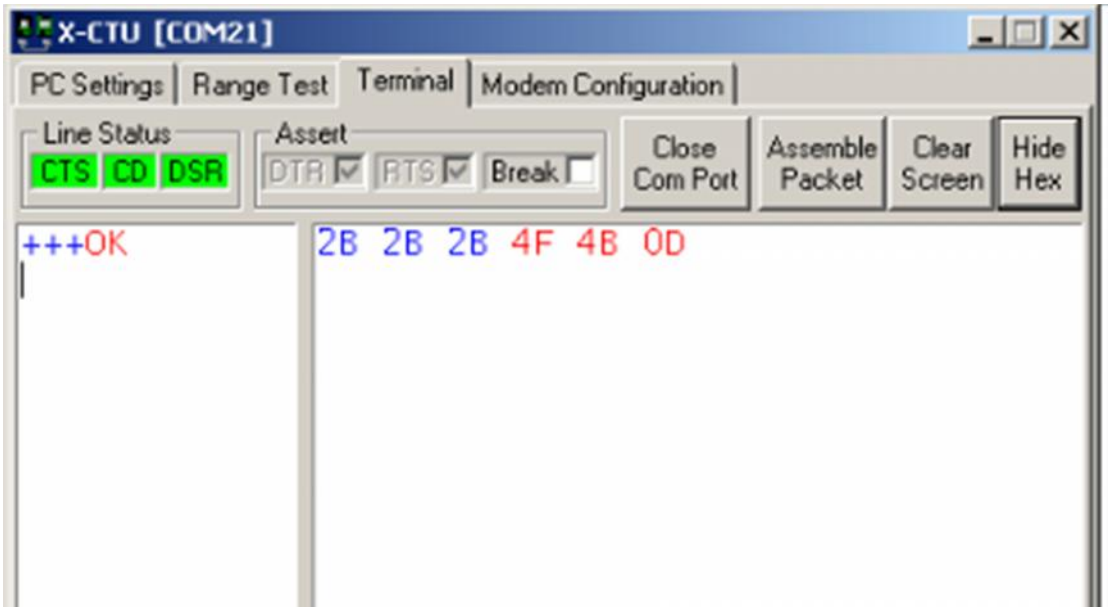


Figure 3.21: X-CTU Configuration

From the figure above, there are two colors which are blue and red. Blue colors the data types from computer and directed out to the communication port (UART port). Next is the red color. The red color means the incoming data from communication port of the PIC to the RS232 connection. Normally to do this testing, it requires DB9 connection or commonly known as RS232.

CHAPTER 4

RESULTS AND DISCUSION

In this chapter, the circuit design is being tested and the failure of the circuit is being troubleshooted. The steps for the testing are shown in this part.

4.1 Project Hardware

The completed hardware design is shown as below.

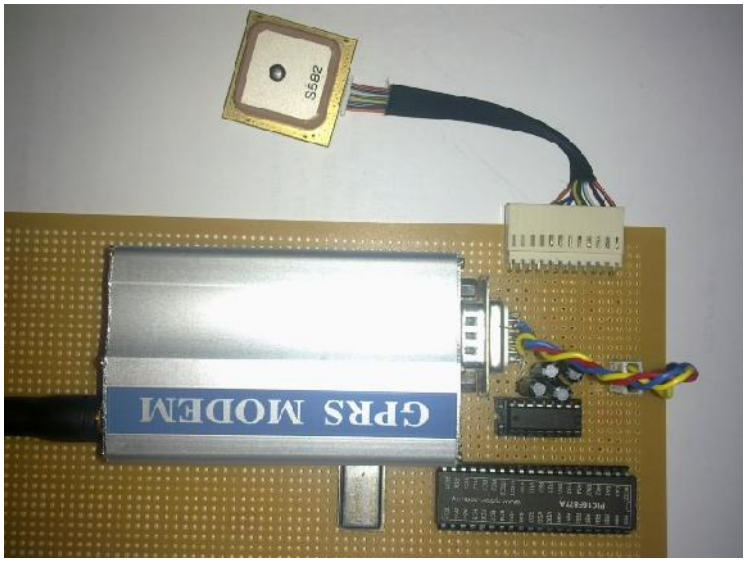


Figure 4.1: Completed Circuit Design

4.2 Project Test on Software

Before the project is being fabricated, the prototype of the project is tested. The program of the PIC is tested using X-CTU. This is the example just to send "*Hello"* to the number "*+60139153008"*.

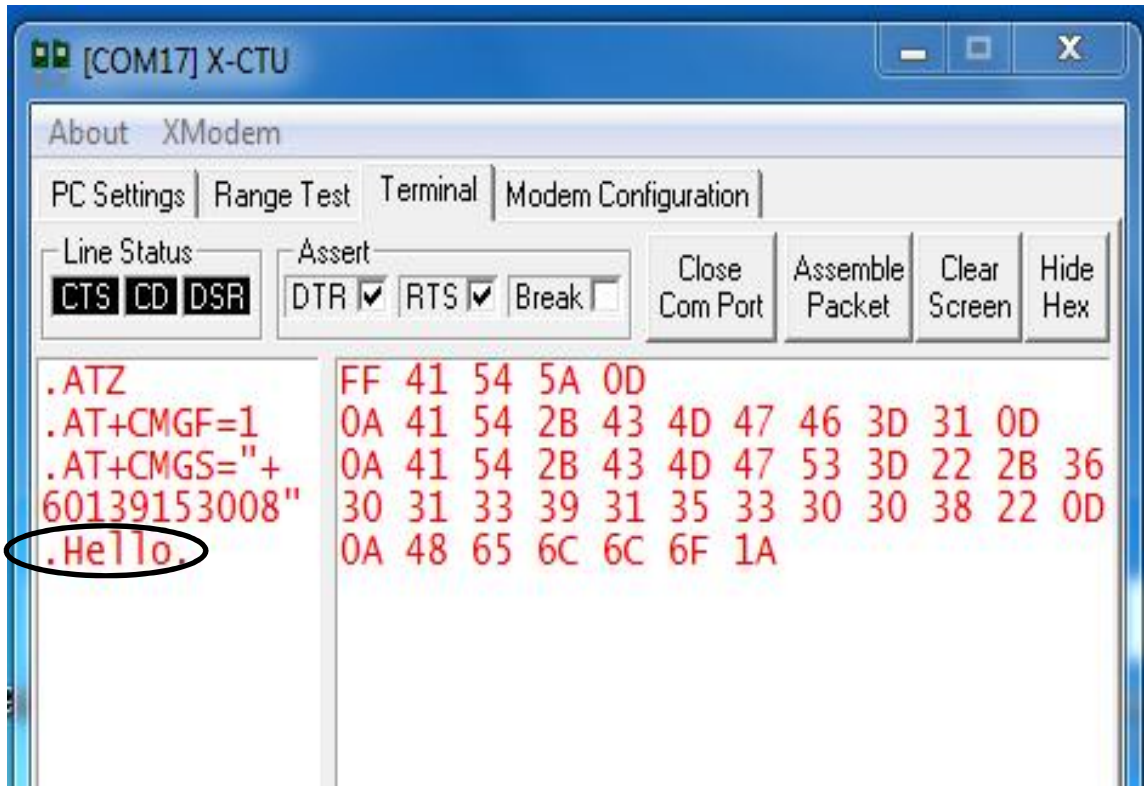


Figure 4.2: PIC Test

This result shows all the connections for the circuit to the PIC are connected well. If the components are not connected well, there is no "*Hello"* message display or there is wrong mobile phone number.

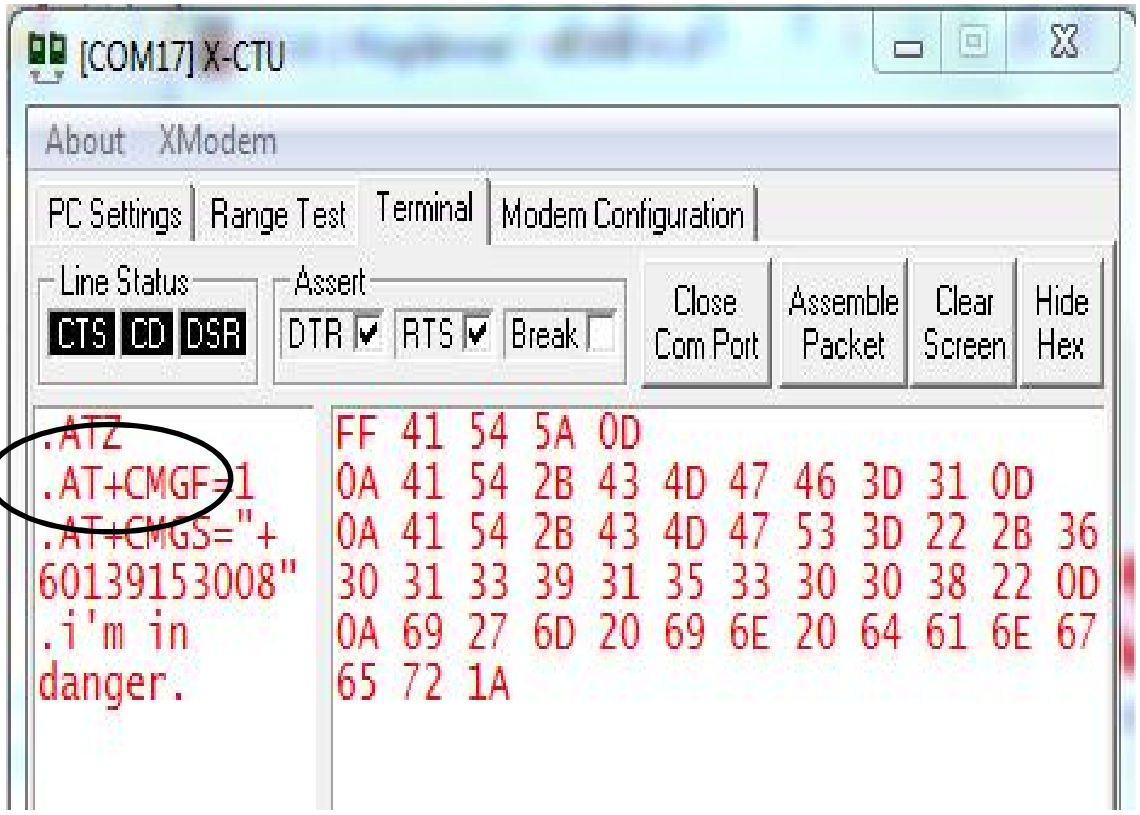


Figure 4.3: Testing For Sending Actual Message

4.3 Project Test on Prototype board

After the test is done using X-CTU, the GSM modem is connected to the protoboard. If the connection for the GSM modem is correct, the message can be sent to the mobile phone.

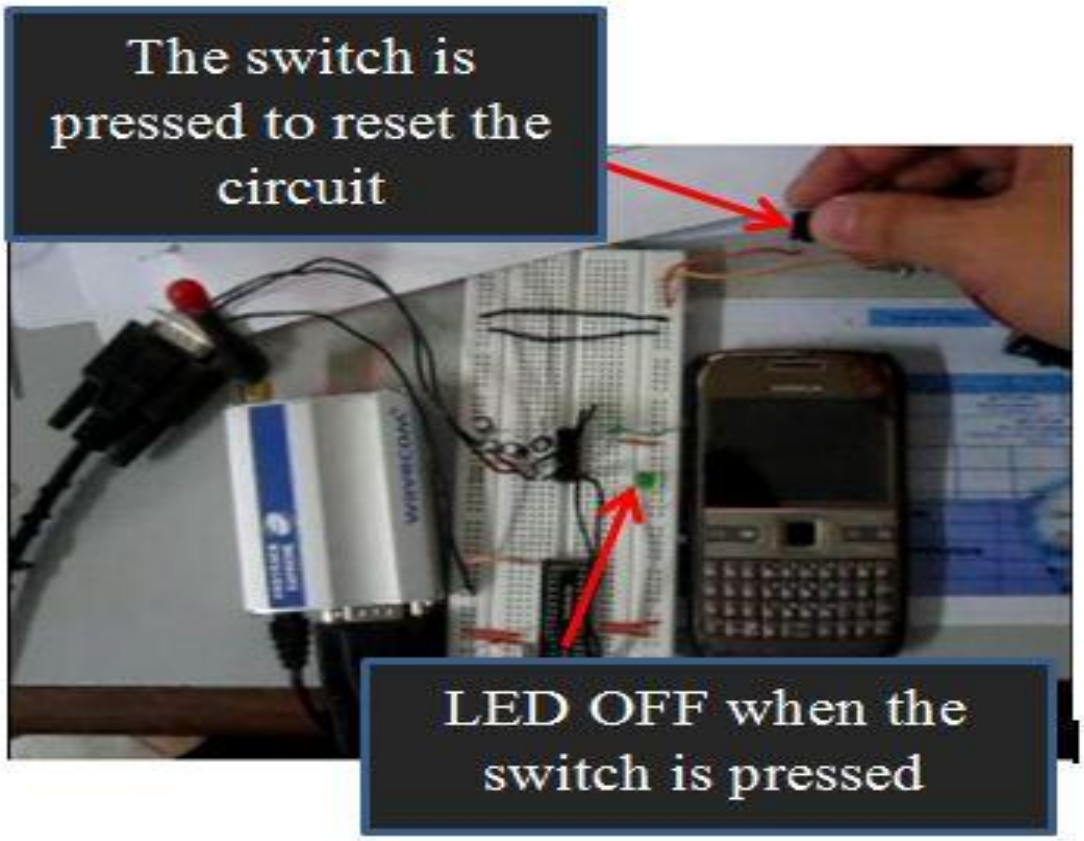


Figure 4.4: Reset the Circuit

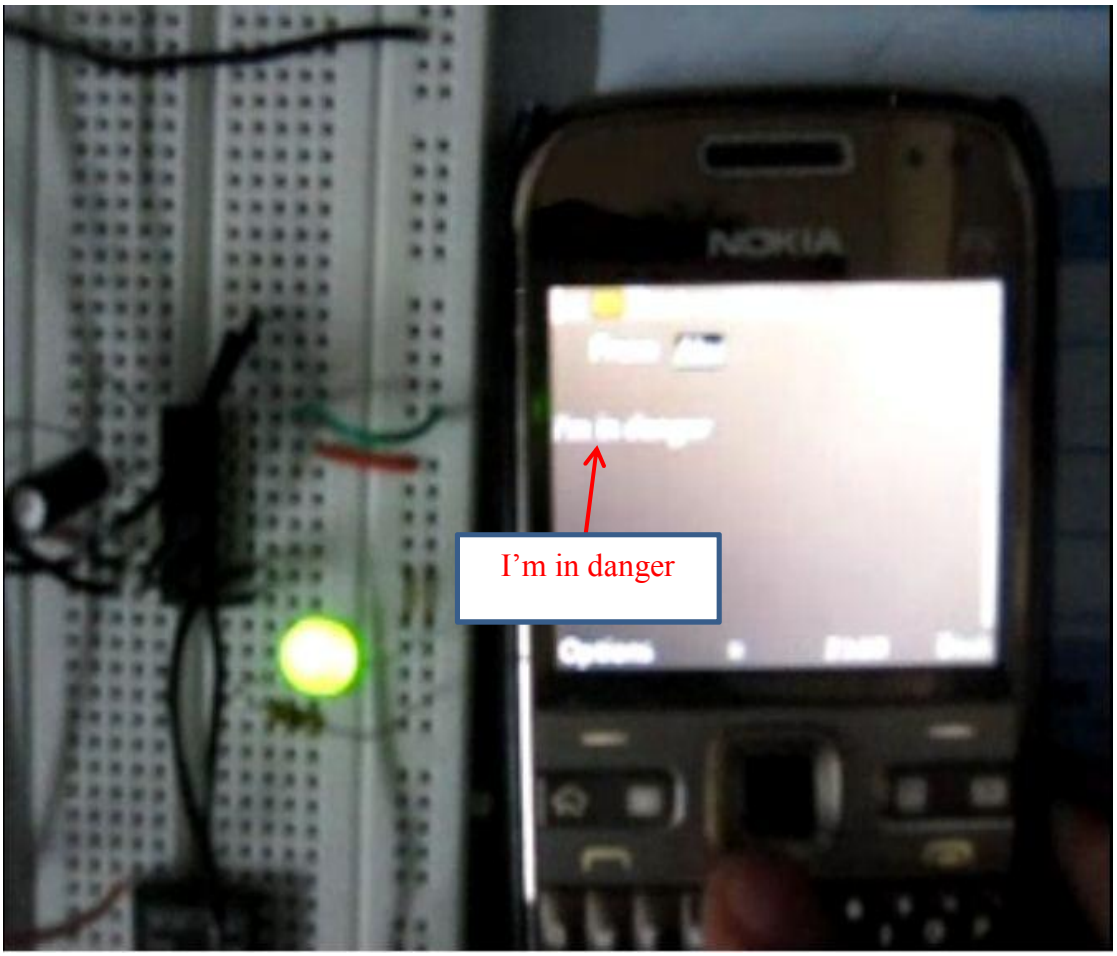


Figure 4.5: Message Has Been Sent To Mobile Phone

From the figure 4.5, we can say that this project is able to send the emergency message to the mobile phone with only one button is pressed. But there is no message for location such as longitude and latitude are being sent.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction of Conclusion

The aim of this project is to send the SOS message that can alert the receiver about the danger. For the conclusion, this project has been successfully designed and tested. The message can be sent to the user when the button is pressed. The system needs to create the interface between receiver 433MHz, GSM modem and GPS module. This entire element is being controlled by microcontroller that will act as the brain of this project. The microcontroller will control the message sending when receives the signal from receiver 433MHz.

For longitude and latitude, this design is not completed yet because the system is unable to send the message with the data that already read by the GPS. It is because there are some errors in the programing related to the GPS module. But the system still can send the message "*i'm in danger"*.

5.2 Project limitation recommendation

This project has several limitations that can be improved. For example is the distance between transmitter 433MHz to the receiver 433MHz. As mentioned in the

scope of study, the distance is limited until 100m only. Further than that, the signal does not reach the receiver. To overcome this problem, we need to change the transmitter and receiver. Besides that, we can also change the antenna. Instead of using copper wire as the antenna, we can change it using high gain antenna. Next the other suggestion to increase the length is replace the transmitter with the GSM. The coverage of the GSM is same with the module phone, so it is suitable for the long distance.

Next is about the data received from the GPS module. The data that received from the GPS such as longitude and latitude is not 100% correct. There is still minor error in calculating the distance and location by the satellite. But it is still can be used because the range are below than 1km square of area. To overcome this problem, the GPS module that is used must have high sensitivity. So that, it can measures the location correctly.

Then, it is about GSM module. This GSM module uses SIM card to operate. The SIM card can be obtained from the provider such as Celcom, Maxis of Digi. For this project, I use SIM card from Celcom. The main problem is the balance credit in the SIM card. So, when dealing with this system, the credit left must always be checked, so that the system can run properly. Besides that, using the different provider also make the system fail to send the message. Even though it is only simple modification in the programming, but it will give major impact to the system.

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APPENDIX A

PANIC ALARM SYSTEM

DAS1100

Distress alertsystem

- Alerts friends and family at the press of a button
- Allows independence while keeping you in touch
- Helps you maintain your active lifestyle

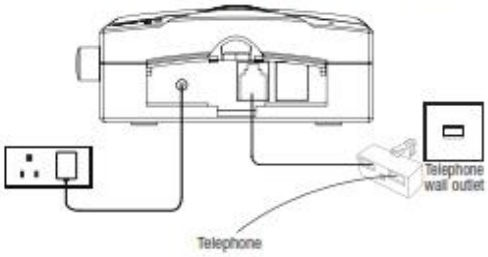
User Manual

Keep this manual safe for future reference

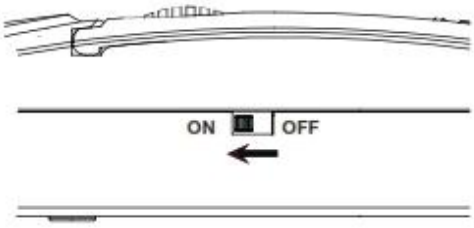
An ASSA ABLOY Group brand

ASSA ABLOY

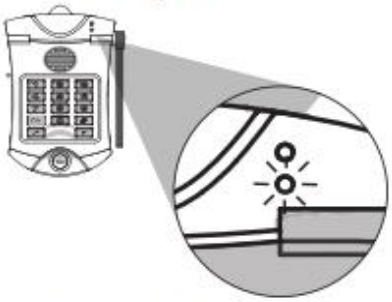
Step 1. Connection
- Lift cover at rear of unit



Step 2. Turn on main unit

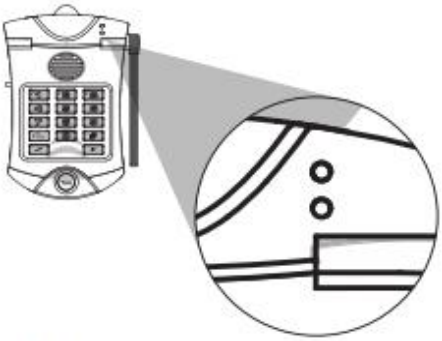


Step 3. Red light stops flashing & stays lit

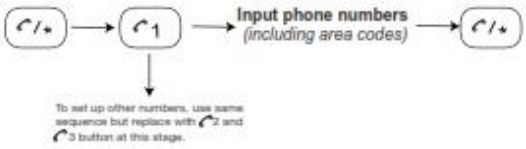


Step 4. Press keyfob button

Step 5. Red light will turn off



Step 6. Set maximum 3 phone numbers


Input phone numbers
(including area codes)
To set up other numbers, use same sequence but replace with 2 and 3 button at this stage.

Step 7. Recording voice message

Step 8. Play back voice message

Press ▶ to play back pre-recorded message.

Repeat step 7 if required.

Set-up is now complete

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APPENDIX B

GSM MODEM

5. Installation

a) Open the SIM card holder, insert in a valid SIM Card provided by GSM network operator or service provider.
b) Install the GSM Modem to your location and connect the antenna to the SMA connector.
c) Fix the serial cable to the GSM modem, the supplied cable will connect the unit to a PC. For other devices you may need a crossover cable.
d) Connect the GSM Modem power supply interface with the power adapter's output jack, and then connect the adapter to its power supply source.

Make sure that all connections are properly

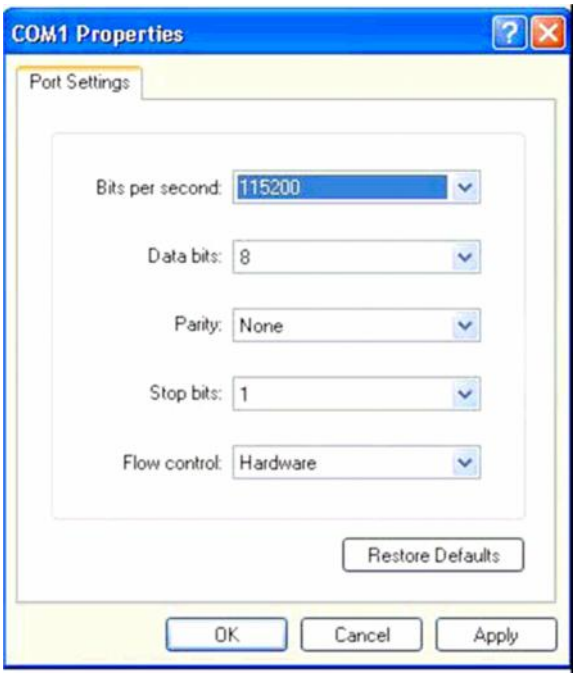
6. Modem Basic Operation

A. Module connection with **Hyper Terminal**.

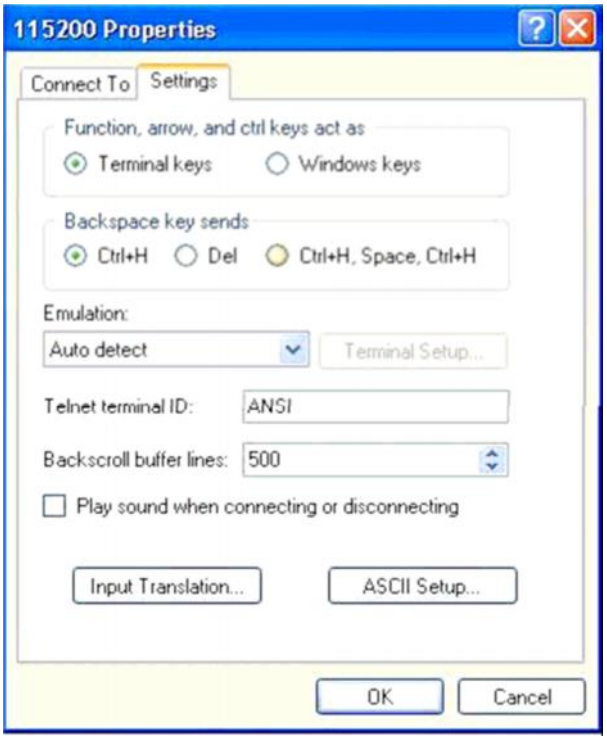
1. Establish or Open **Hyper Terminal** from **All Programs** Æ **Accessories**-Æ **Communications** and setting up relevant parameters. Module baud rate is 115200. (1). Establish connection.

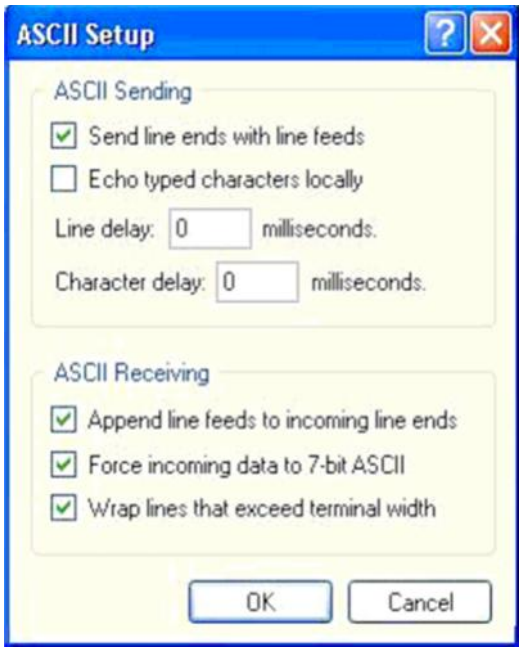
(2). Setting up usage port.

(3). Setting up port parameters.



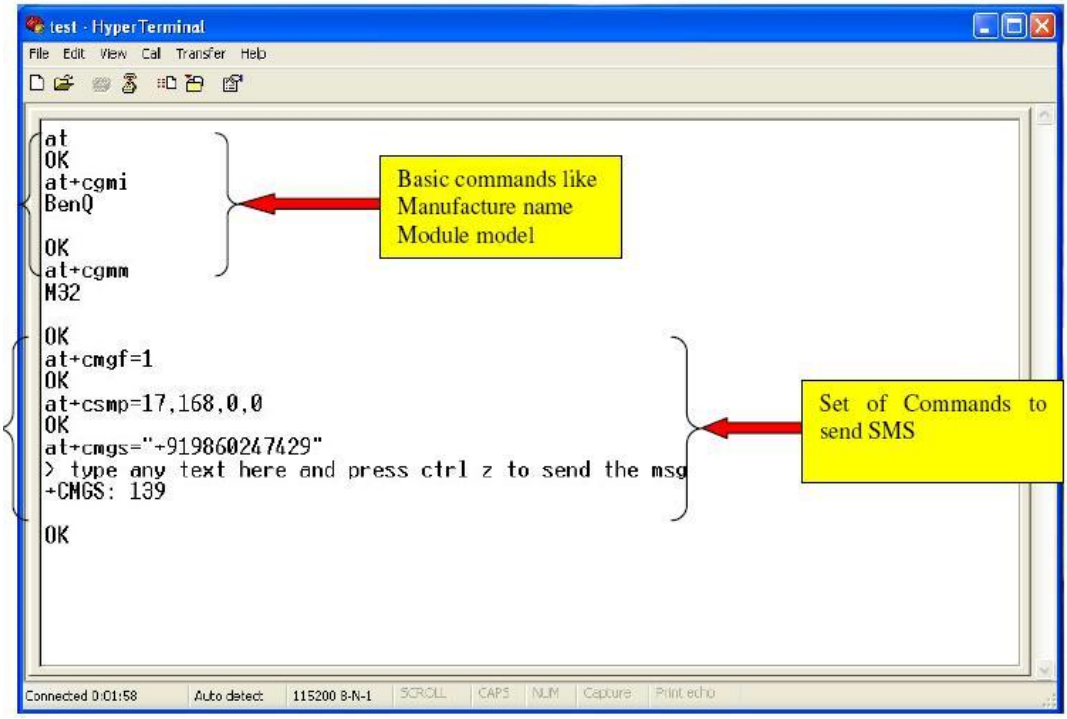
(4). Setting up **property** in **File** Menu of **Hyper Terminal**





2. You can input word "AT" then press "Enter" key, it should be response word "OK" means work property. **All commands are executed by pressing "Enter" key.**

Example as below:



3. If SIM card requires switch on password, please enter: **AT+CPIN= "password"**

4. Read module information

AT+CGMI （Manufacture name ） **AT+CGMM** （Read Module model）

AT+CGMR (Read module current SW version information)

AT+CGSN (Module serial number)

B. Dial call or receive call (Modem doesn't provide voice port even with relevant command)

1. Dial call **ATDxxxxxxxxx；** （xxxxxxxxx is phone number，example：ATD1860；）
2. Call waiting function：**AT+CCWA**
3. Hold function：**AT+CHLD=?**
4. Dial latest call number：**AT+CLCC=?**
5. Enter information once connection established（DTMF）：**AT+VTS=（0-9，#，*，A-Z）**

Dial Extension number（example：1234）：**AT+VTS=1**

AT+V TS=2

AT+V ST=3

AT+V ST=4

6. Receive call: **ATA**
7. Hang off call: **ATH**
8. Incoming call ID: **AT+CLIP=1**

9、SMS function：

⑴ Setting up SMS Center number：**AT+CSCA= "+8613800XXXXXX" ，145**

SMS Center number：+8613800XXXXXX

⑵ TEXT parameter：**AT+CSMP=17，168，0，0** English format

AT+CSMP=17，168，0，0 Chinese format

⑶ Send SMS：**AT+CMGS**

⑷ Read single SMS：**AT+CMGR=1**

⑸ List multiple SMS：**AT+CMGF=1**

AT+CM GF=4

(6) Delete SMS：**AT+CMGD**

Example 1：Send English character SMS

AT+CMGF=1
AT+CSMP=17，168，0，0
AT+CMGS= “Telephone number”

>Character information Ctrl+z

Example 2：Send Chinese character SMS

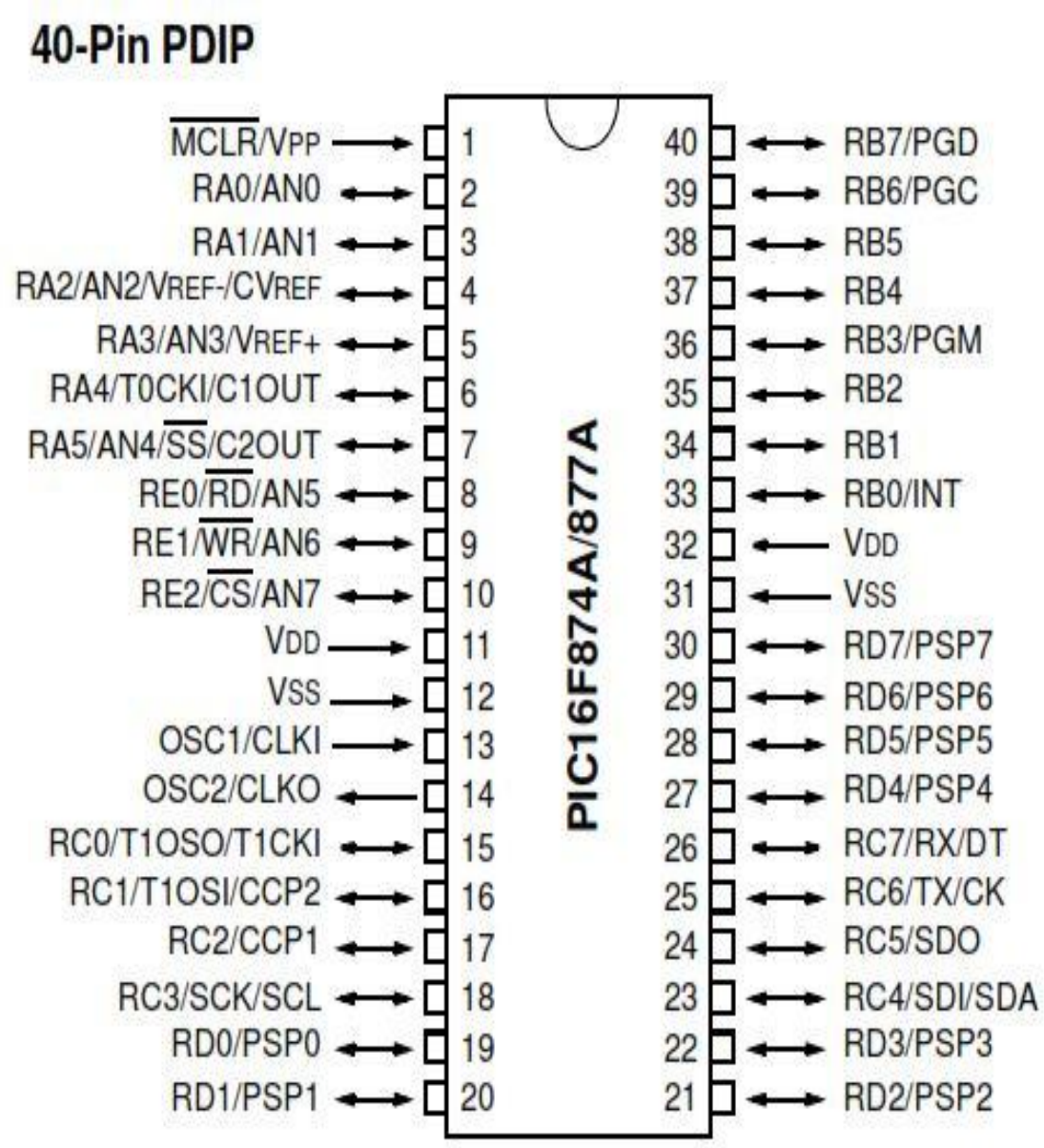
AT+CMGF=1
AT+CSMP=17，168，0，8
AT+CMGS= “Telephone number”

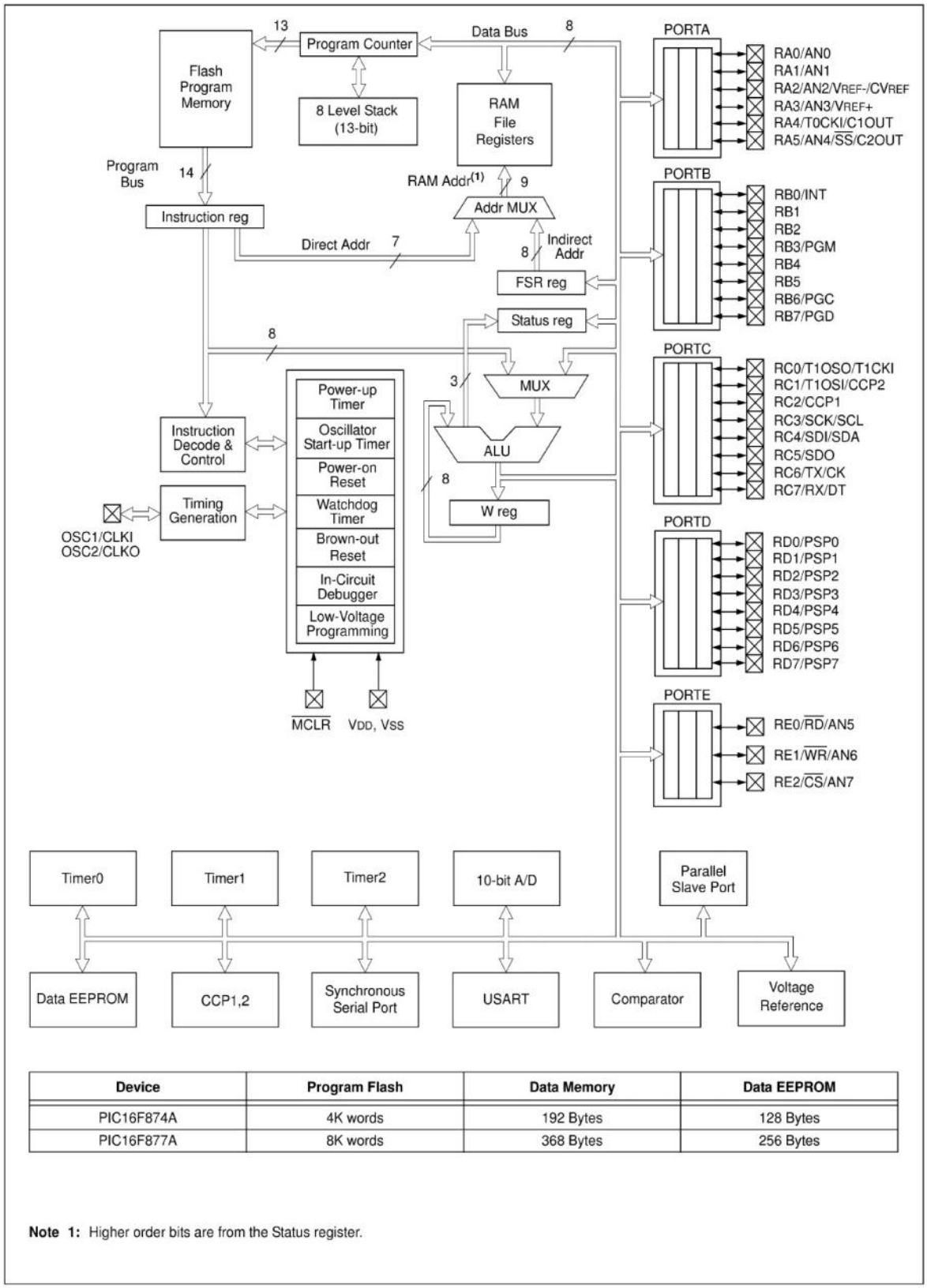
>Chinese character information Ctrl+z

10. Chinese character information is Unicode.

APPENDIX C

Pin Instruction and Internal Architecture for PIC16877A





Device	Program Flash	Data Memory	Data EEPROM
PIC16F874A	4K words	192 Bytes	128 Bytes
PIC16F877A	8K words	368 Bytes	256 Bytes

Note 1: Higher order bits are from the Status register.

APPENDIX D

6. INSTALLATION (HARDWARE)

This section will show the connection during UIC00B usage.

6.1 Using UIC00B with application circuit (development board)

1. Connect A-type USB connector (one end of USB cable) to USB port at laptop or PC desktop.

2. Connect another end of USB cable (mini) to UIC00B USB port.

- Power supply indication green LED will light ON.

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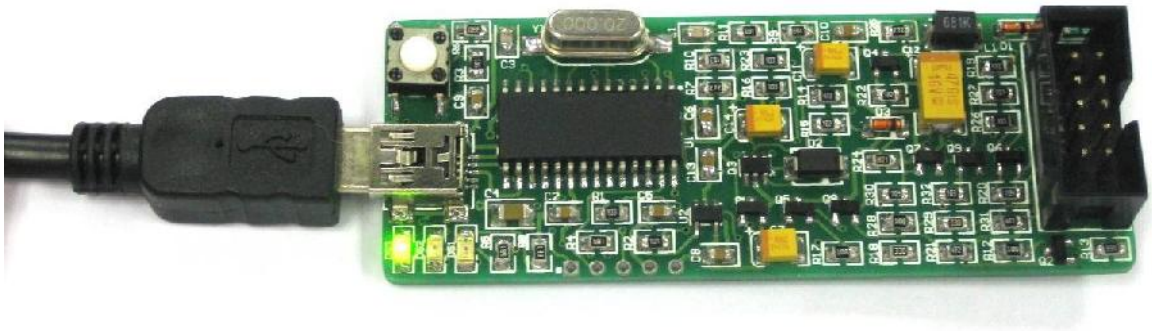
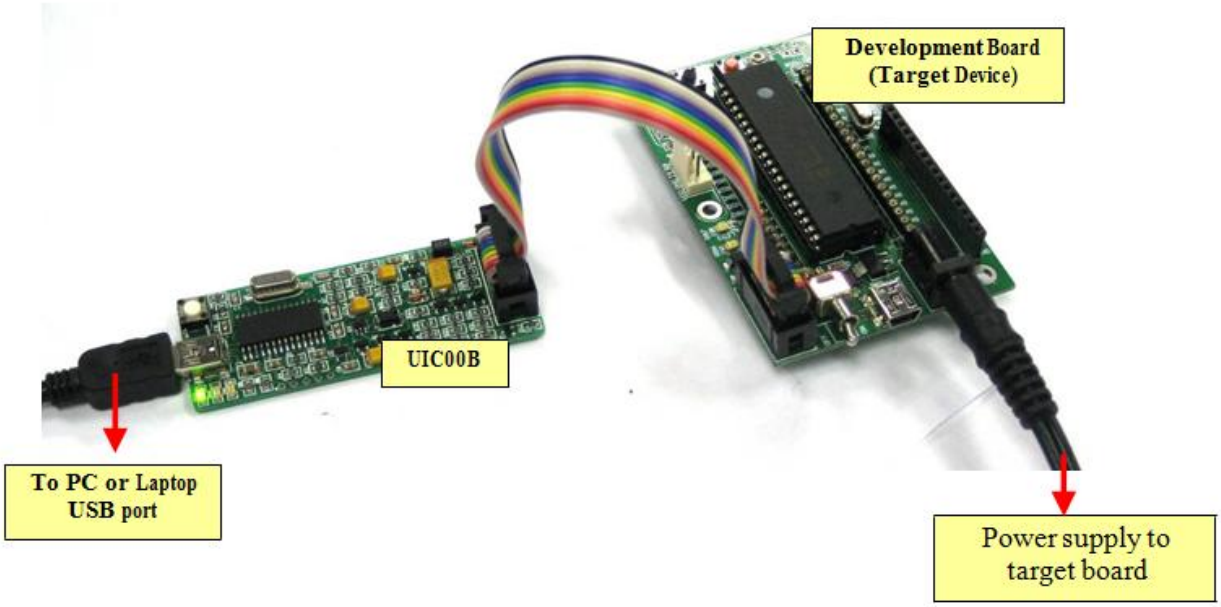


3. Continue to software installation if this is the first time usage. Refer to section 6 for software installation guide.



4. Connect one side of programming cable to box header of UIC00B and the other side to box header of development board (target device) to be program.

- Use external power for the target board, UIC00B cannot support large power usage.

Caution: USB port current limit is 150mA. If the target and UIC00B exceed this current limit, the UIC00B board might be damaged. The target board should be powered externally.

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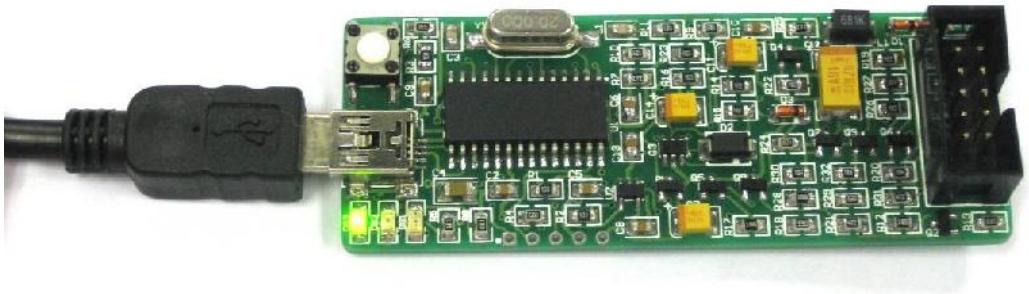
6.2 Using UIC00B with UIC-S (optional, buy separately)

1. Connect A-type USB connector (one end of USB cable) to USB port at laptop or PC desktop.

2. Connect another end of USB cable (mini) to UIC00B USB port.

• Power supply indication green LED will light ON.



3. Continue to software installation if this is the first time usage. Refer to section 6 for software installation guide.

4. Connect one side of programming cable to box header of UIC00B and the other side to box header of UIC-S board.

• No external power required for UIC-S to function.

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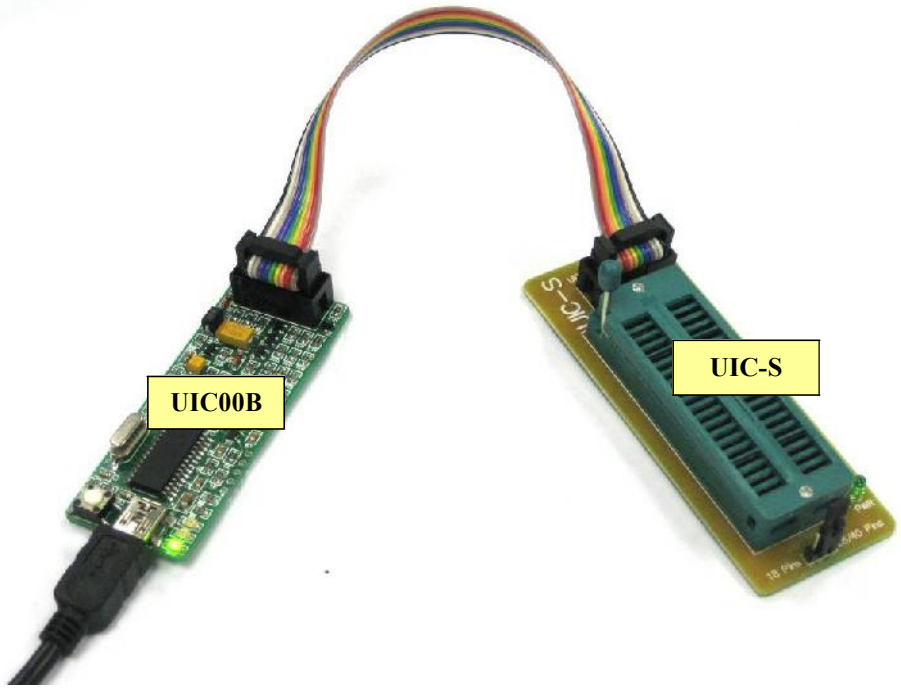

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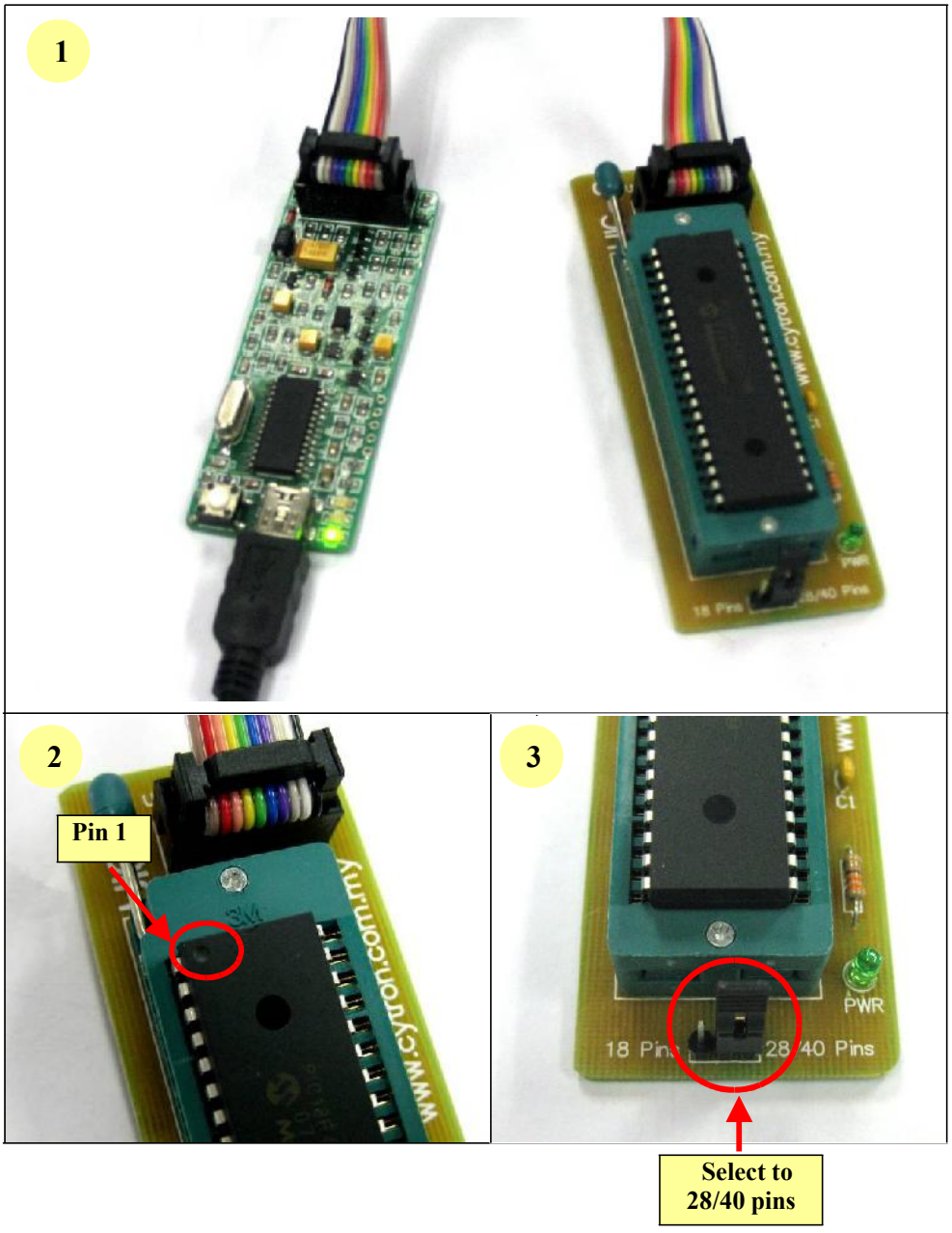
6.2.1 Plugging the microcontroller

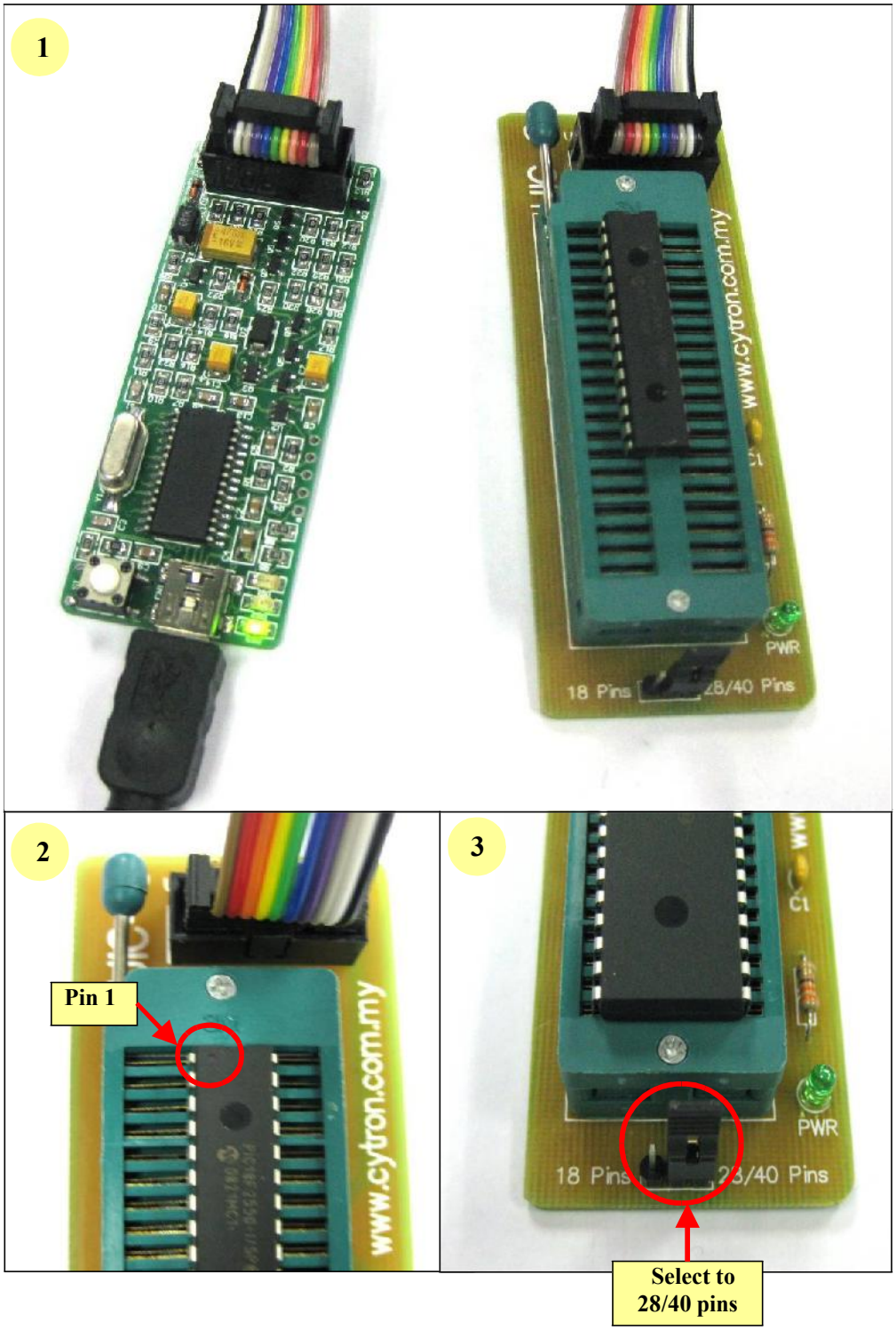
40-pin Microcontroller

- Plug in the microcontroller at the ZIF socket and select 40 pins at label "28/40 Pins" using mini jumper as shown below.



28-pin Microcontroller

- Plug in the microcontroller at the upper portion of the ZIF socket and select 28 pins at label "28/40 Pins" using mini jumper as shown below.



18-pin Microcontroller

- Plug in the microcontroller at the lower portion of the ZIF socket and select 18 pins at label "18 Pins" using mini jumper as shown below.